NATIONAL MARITIME MUSEUM
SAN FRANCISCO

CONDITIONS INVESTIGATIONS AND WATERPROOFING ASSESSMENT

SAN FRANCISCO MARITIME NATIONAL HISTORIC PARK
NATIONAL PARK SERVICE

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INTRODUCTION

This report, commissioned by the Western Region of the National Park Service (NPS), presents the findings of a conditions investigation of the Maritime Museum Building (The Aquatic Park Bathhouse), located at the San Francisco Maritime National Historical Park on Beach Street in San Francisco. The report was originally intended to address water penetration problems at skylights and in roof decks, but was later expanded to include an evaluation and recommendations for treatment of the entire building envelope. An earlier investigation by Architectural Resources Group deals with restoration of the windows in the Museum Building, and thus these elements are not covered in this study. Architectural Resources Group (ARG) was assisted by Rosenberg McGinnis, AIA, Inc., a firm specializing in waterproofing, for diagnosis of conditions and treatment recommendations.

During the course of the investigation, additional architectural services were provided by ARG for preparation of specifications for temporary repair of the roof decks, clearing of drains, and repair of spalls in roof curbs. This work was completed in February of 1992.

Historic research was conducted to locate original drawings and construction photos of the building. A limited number of original drawings, as well as construction photos, are in the collection of The J. Porter Shaw Library of the Maritime Museum. A more extensive set of drawings of the structure, and drawings of the Aquatic Park comfort stations, were found at the Recreation and Parks Department of the City and County of San Francisco. The Maritime Museum Building was formerly a city owned property, and was managed by the Recreation and Parks Department. The drawings which were in possession of the City have now been transferred to the J. Porter Shaw Library. Some differences were noted between the drawings and existing conditions; however in general the drawings appear to be relatively accurate. All historic photos are courtesy of the San Francisco Maritime National Historic Park Collection.

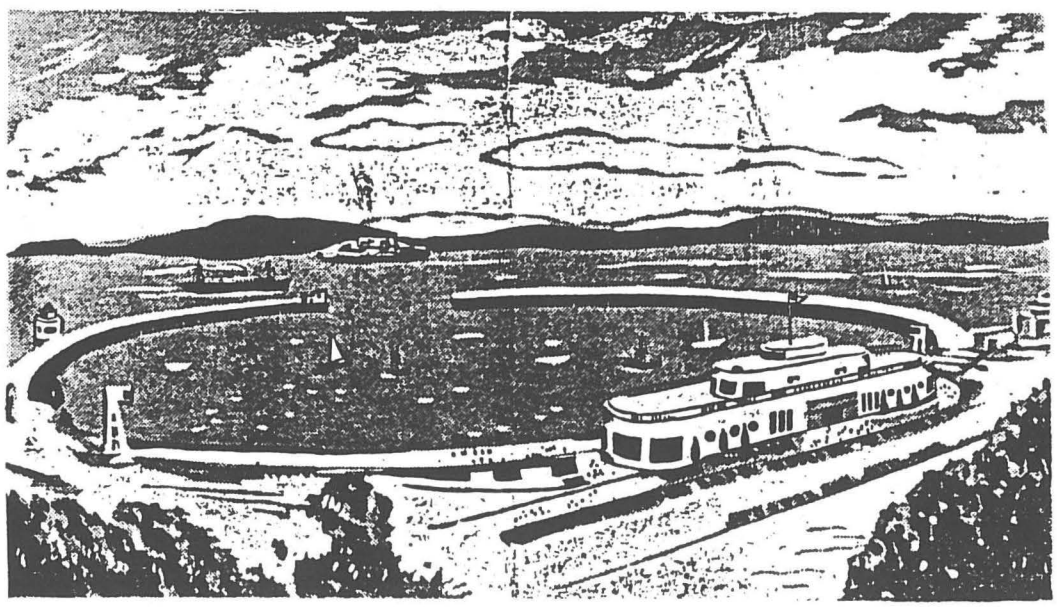


Illustration from Aquatic Park menu cover.

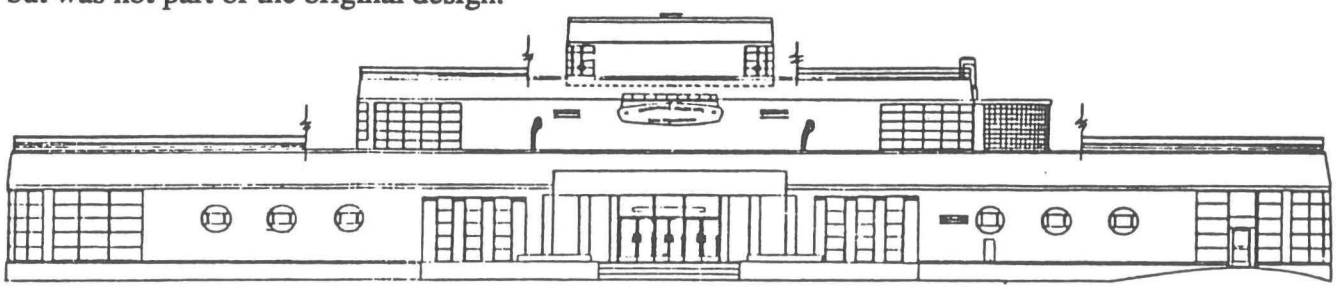
BACKGROUND

The Maritime Museum Building, originally designed as a municipal bathhouse, was constructed between 1930 and 1938 as part of San Francisco's Aquatic Park recreational complex. The Streamline Moderne structure was built by the federal government's Works Progress Administration (WPA), and was designed by noted San Francisco architects William Mooser, Sr. and William Mooser, Jr. During World War II, the Army occupied Aquatic Park and took over management of the bathhouse facility from the San Francisco Park Commission. In 1978 the structure was transferred from the City to the National Park Service as part of the new Golden Gate National Recreation Area. The Park Service completed nomination of Aquatic Park to the National Register of Historic Places in 1979 as the "Aquatic Park Historic District". Aquatic Park, including the Maritime Museum Building, was listed on the National Register in 1981.

The reinforced concrete building retains most of its original features such as stainless steel clad windows, bronze spotlights, and stainless steel vents which are shaped to look like ship funnels. The interior of the building continues the marine theme with painted wall murals, tile mosaics, and terrazzo floors. The structure is oriented along an east-west axis parallel to Beach Street and consists of a four story central structure with one story wings to the east and west (see site plan in Appendix A.) The ground or first floor of the building, including the two wings, is built into the low hillside between San Francisco Bay and Beach Street. The north elevations of the two wings consist of reinforced concrete bleachers, and each of the wings contain bathing facilities; men's in the east wing, and women in the west. At the east and west ends of the central structure are driveways which follow the curved contour of the building connecting the north and south elevations, as well as visually separating the wings from the central structure. Wing roofs support approximately 2-feet of soil planted with grass, and are penetrated by skylights which project into the grass area, and were originally intended to provide natural light for the dressing rooms.

The general design of the above grade portion of the building is reminiscent of a 1930s ocean liner with smooth curved walls and flat roofs which serve as observation decks. The second, third, and fourth floors of the buildings are rectangular in plan with the east and west ends terminating in semi-circular walls with stainless steel windows. The plan of the third and fourth floors progressively diminishes in size thus creating space for the exterior observation decks at each of these floor levels. Surrounding the observation decks are stainless steel and aluminum railings.

The main entrance of the second floor is on the south elevation. It consists of three pairs of double leaf glass doors with canopy surrounded by a masonry bas-relief sculpture integrally designed with two, low fountains which flank the entrance steps. On the north elevation of the second floor is a veranda which runs almost the entire length of the building. The symmetry of the building is broken on the third story by a flat roof, glass block wall pantry at the east end. The pantry was built as part of the initial construction, but was not part of the original design.



South Building Elevation

MAINTENANCE HISTORY

The National Park Service has made a concerted effort to maintain the Museum Building, and its condition has greatly improved since the time the structure was managed by the City. Significant waterproofing problems do remain, however. These conditions have resulted in damage of interior finishes such as painted plaster and murals. The skylights are in very poor condition, roof deck tiles are badly cracked, and there are numerous cracks and spalls in the concrete bleachers. Windows have also been a source of water infiltration, and a separate report by ARG has been completed which covers treatment options for the windows.

Some recent maintenance history of the Aquatic Park Bathhouse can be gleaned from NPS files and the Historical Data Section of the Historic Structures Report for Aquatic Park written by James P. Delgado, former Golden Gate National Recreation Area Park Historian. Between World War II, and transfer of Aquatic Park to the NPS in 1978, the facility was operated by the City of San Francisco. It is evident that the City's maintenance program for the structure was quite lax; reports of deterioration such as water leaks and peeling paint were mentioned in this period by the local press. The poor condition of the roof and skylights was specifically identified, and by 1970 the park was described in the San Francisco Chronicle as a "sad dump." Delgado recounts that the City applied a red asphaltum membrane over the observation deck tiles which had cracked and lifted.

Near the end of 1982, the existing urethane coating was applied by the NPS in an attempt to stop water penetration. Preparation for the coating included removing the membrane installed by the City, and sandblasting of the tile. Correspondences indicate that it was not known prior to removal of the membrane that the deck tiles were still in place.

After the urethane had been applied in one area, problems developed with adhesion and bubbling of the coating, and were attributed by NPS personnel to application over tiles which were not thoroughly dry. Despite the wetness of the substrate, it was decided that at least one coat of the topping should be applied to the deck in the hopes that this would provide some additional protection against water coming in contact with the interior wall murals. It was recommended at this time that the contract be re-evaluated as the product manufacturer would not warranty the application due to the existing conditions. As can be seen today, the urethane coating was applied to all of the tile observation decks. As noted in the INTRODUCTION, cuts, splits, and other defects in the coating were repaired February of 1992.

REPORT NOMENCLATURE

On the original drawings the ground story is referred to as the first floor and subsequent floors correspondingly numbered. These same designations are used in this report. The subterranean wings, portions of which are beneath bleachers and lit by skylights, are referred to as either the east or west wing. The term "museum building" is used to refer to the above ground central portion of the Aquatic Park Bath House exclusive of the east and west wings.

METHODOLOGY

For the purposes of confirming existing conditions exploratory demolition was performed. One excavation was made in the third floor observation deck on the north side adjacent to the outer curb. Another excavation was made next to a skylight curb in the west wing subterranean roof deck. A third excavation was made in the east end driveway at the building wall. Cores of the eastern-most bleacher concrete were taken for analysis to help

in determining the cause of extensive spalling. Three were taken from beneath the bleacher with one core drilled completely through the slab and topping. Two glass lites in a east wing skylight were removed in order to examine existing conditions. This exploratory demolition work was coordinated with the temporary roof repairs. Proposed treatment details are shown in Appendix B. Elevation drawings with condition notes are included in Appendix C.

In Section I of this report descriptions and conditions of architectural components are discussed. Section II provides repair/restoration options and recommendations.

SECTION I - DESCRIPTIONS AND CONDITIONS

Note: The locations of the exploratory excavation done for the observation decks subterranean decks, and driveways are indicated in Appendix B. Locations of exterior conditions are recorded on elevation drawings in Appendix C.

EXTERIOR WALLS

Description

The main exterior walls of the Maritime Museum are cast-in-place reinforced concrete with a stucco finish which is painted. The walls were most recently painted in 1990. Roof deck perimeter curbs have been repeatedly repaired particularly at locations where stainless steel railing posts are imbedded into the curbs. The original drawings indicate that the curb copings are limestone. These copings have been parged with cement plaster and therefore the original material is no longer visible, however the existence of limestone beneath the parging was confirmed during the exploratory demolition.

Condition

The reinforced concrete walls appeared to be in good condition, with minor losses at random locations which had been painted over and appear sound. (The specific conditions of windows and window jambs is discussed in a previous report by ARG). There is one large incipient spall on the north elevation of the penthouse above a window. The parging of the limestone coping caps was presumably necessary due to deterioration of the stone. It has been observed by ARG on other buildings in San Francisco that certain types of limestones do not weather well in this climate.

Incipient spall over penthouse window on north elevation. Photo by ARG.

SECOND FLOOR ENTRANCE SURROUND AND FOUNTAIN

Description

Surrounding the south elevation second floor entrance to the museum is a masonry bas-relief sculpture integrally designed with two, low fountains which flank the entrance steps. The sculpture is composed of individual carved panels of "greenstone", a slate native to the Sierra Nevada foothill region of California. The carved panels are visually linked across the entrance by carved slate panels attached to the face of the entrance canopy. The carvings were executed by Sargent Johnson, one of only two WPA African American artists in California.

The low exterior walls and copings of the fountain are clad with greenstone slate. The shallow fountain pools, which are currently dry, have mosaic tile bottoms and terrazzo base panels. The edges of the fountain panels are joined to adjacent panels with brass pins approximately 1/8-inches in diameter. This construction techniques was likely used for the bas-relief panels as well. No drawings were found of the mural or fountains.

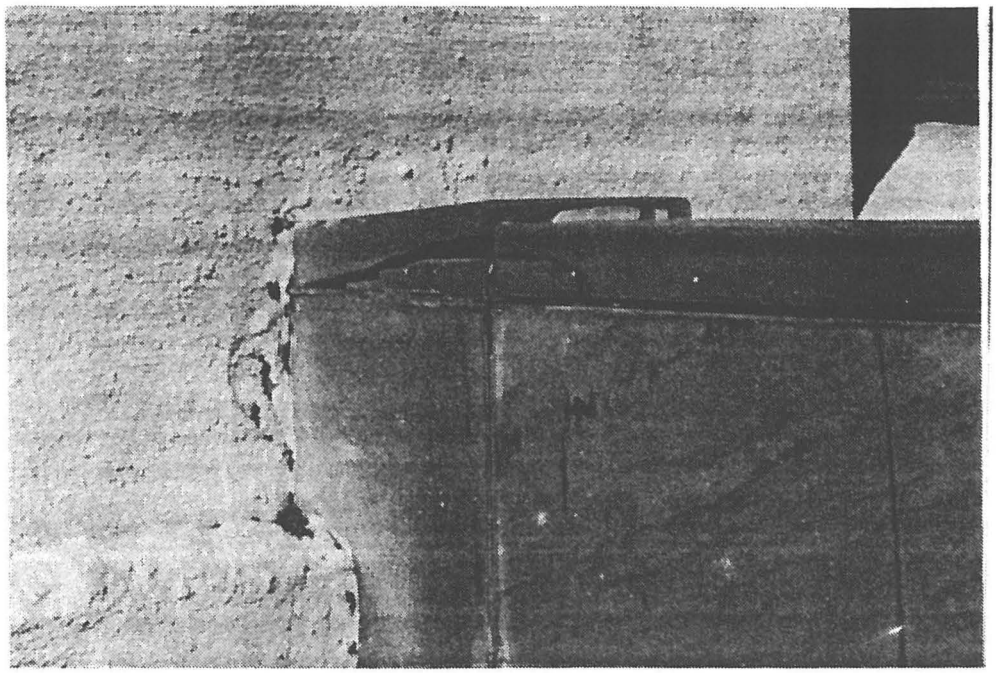
Condition

The bas-relief sculpture and the fountain are in poor condition. Essentially all mortar joints are open, and several fountain coping stones have become loose to the point that removal by vandals is possible. Hairline cracks and losses at arrises are numerous in both slate and terrazzo panels. Significant cracks were noted on a number of slate units (see photo on following page). A whitish discoloration is common near the slate edges and is associated with delamination and exfoliation of stone.

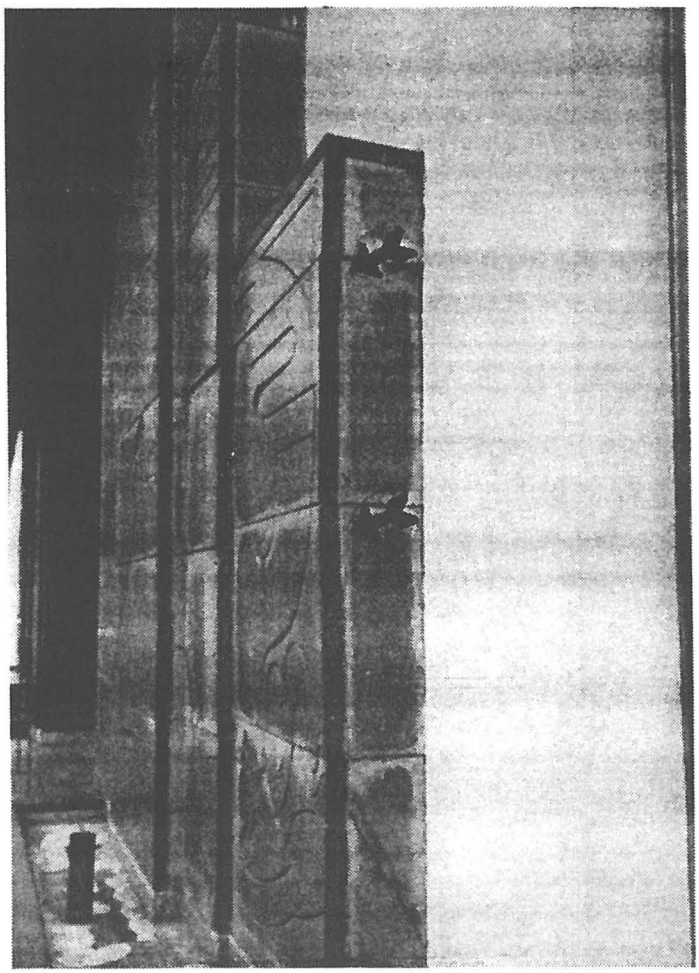
Green patching mortar has been use for repair of losses in terrazzo, but as the patch aggregate does not match that of the terrazzo these repairs are visually disruptive.

In addition to the above conditions, displacement of fountain and bas-relief masonry panels was also observed. The most critical instance of displacement occurs east of the entrance where two, and perhaps three panels are leaning slightly away from the building (see photo on following page). The implications of detachment of these panels in terms of life-safety are obvious. but also significant would be the loss of or damage to these carvings. Panels attached to the face of the canopy did not appear to have suffered displacement.

South elevation entrance surround and fountain. Photo by ARG.



Cracked and displaced coping stone at fountain. Photo by ARG.



Displaced panel. Photo by ARG.

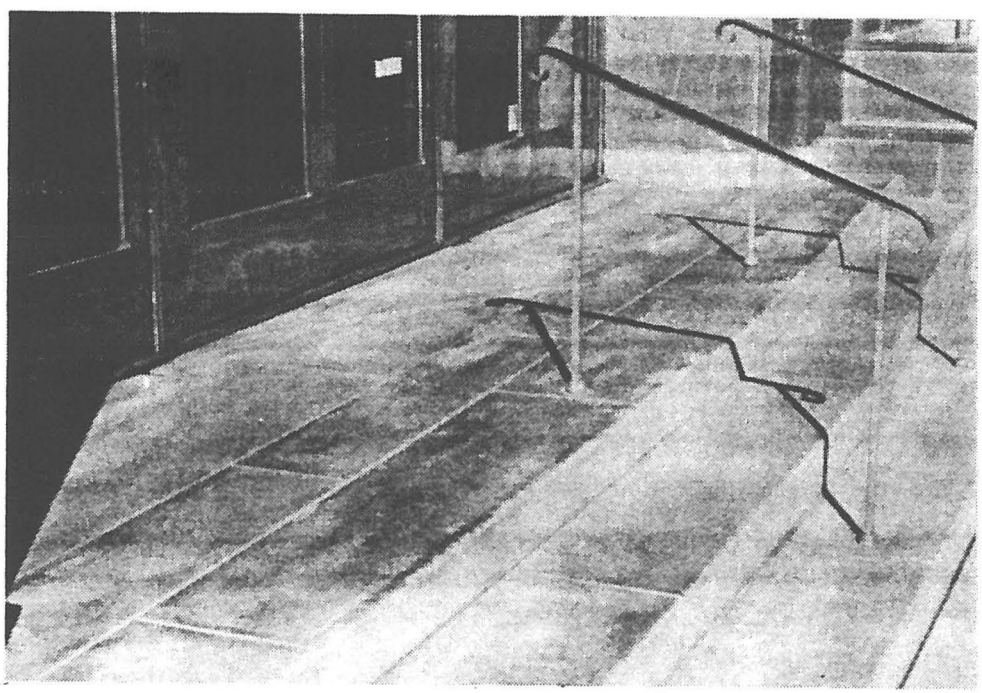
ENTRANCE STEPS

Description

The south elevation entrance steps are constructed of granite masonry and have two metal handrails.

Condition

The steps have a general discoloration and blotchiness which appears to have been caused by the application of a sealer or stone treatment product. It is also possible that there has been some corrosion of metal elements in the canopy, and that corrosion laden condensation moisture has dripped onto the steps causing staining. There are approximately 30-feet of open joints.



Entrance steps detail. Photo by ARG.

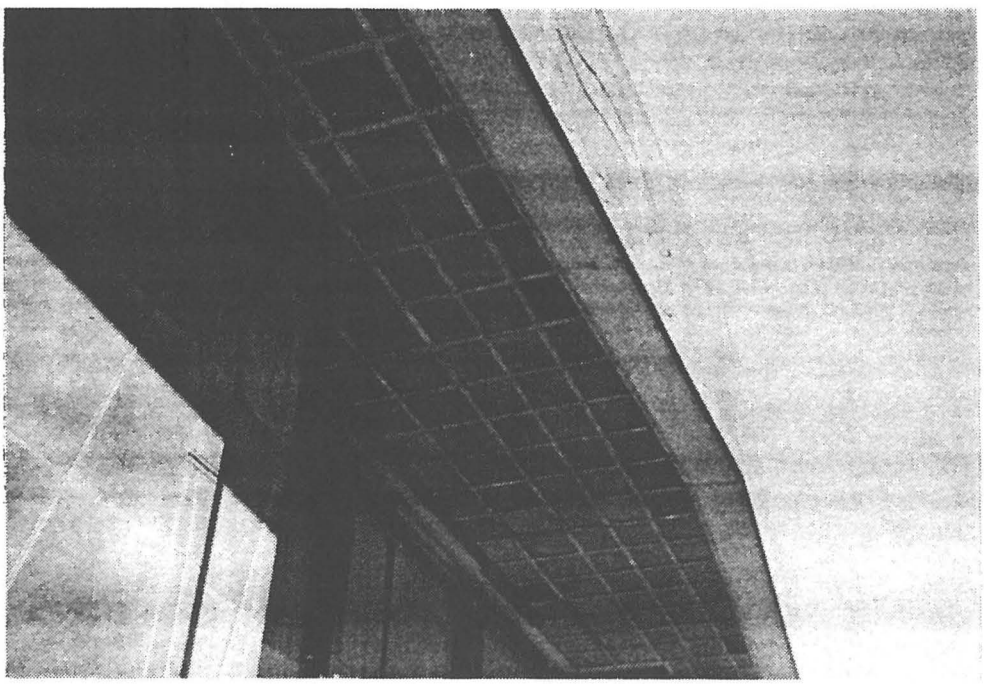
ENTRANCE CANOPY

Description

The face of the steel-framed entrance canopy is clad with slate panels, and the roof is flat seam copper. Conditions of the slate and copper are discussed in other sections. The soffit of the canopy has 12-inch square translucent green glass lites set in an aluminum framework.

Condition

A total of seventeen of the original lites have been replaced either with glass not matching the original, or plywood. Portions of the steel framework were visible from the front edge of the canopy beneath a loose piece of copper flashing. This steel was coated with red lead paint, and appeared to be in good condition. N.P.S. employee Ken Russel of the Maritime Museum indicated he observed no evidence of water intrusion into the canopy when he recently replaced light bulbs in the canopy soffit.



Soffit of canopy. Photo by ARG.

THIRD FLOOR PANTRY

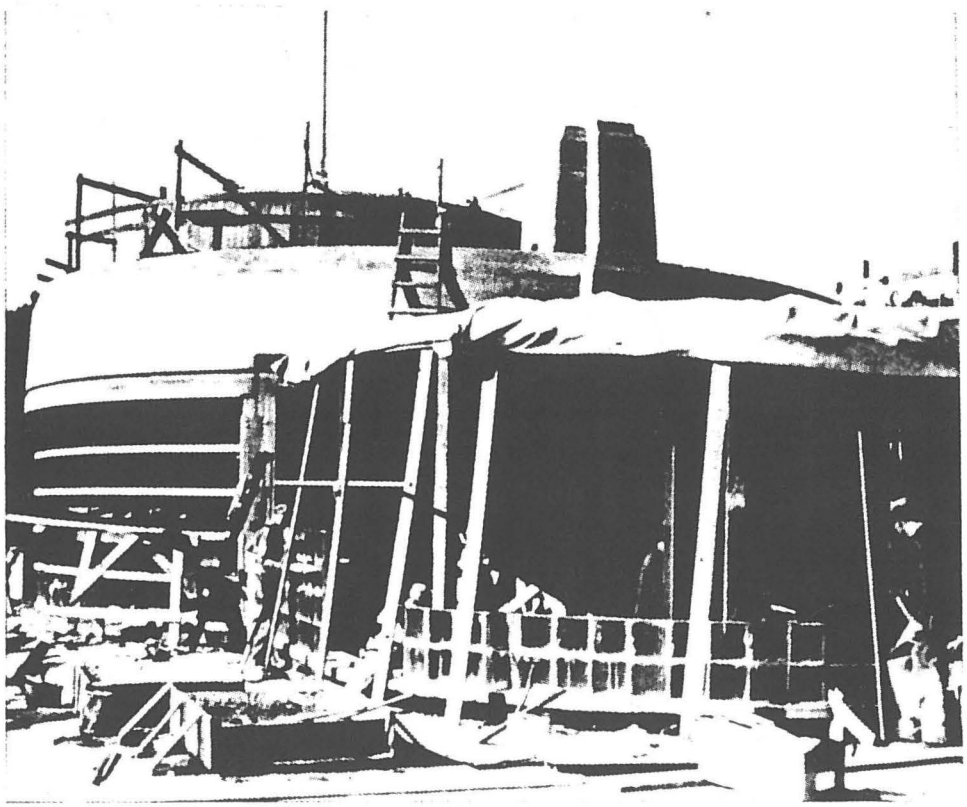
Description

The third floor pantry is a feature which was not part of the original design and was added after construction of the structure had already begun at the demand of the first tenant of the building. It is located on the east end of the structure, and consists of a steel framework supporting a flat roof with a curved wall of glass brick.

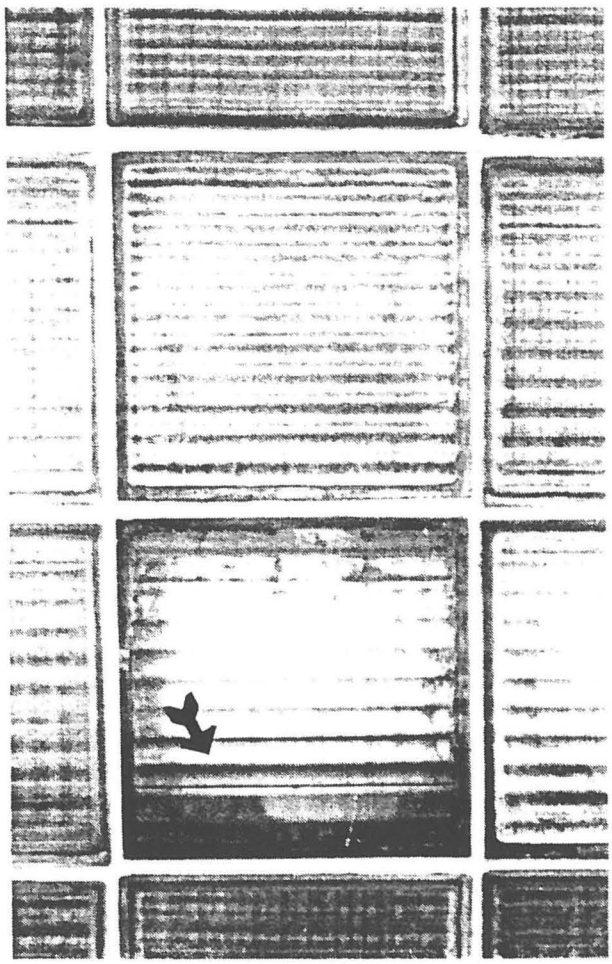
Condition

The glass brick wall is in poor condition. A significant number of blocks are cracked, and the mortar between blocks is generally deteriorated. Further, many blocks have become partially filled with water; some are at least half full (see photo on following page). This is not an unique condition for blocks of this age. Glass block was, and still is, manufactured in two halves which are fused together. Typically, the fused seal breaks down and allows water into the block. As the pantry is in an exposed location and block mortar joints are generally open, it is not surprising that wind driven rain has been able to penetrate into the blocks.

On the northeast side of the pantry there is a slight, but discernable bow in the wall.

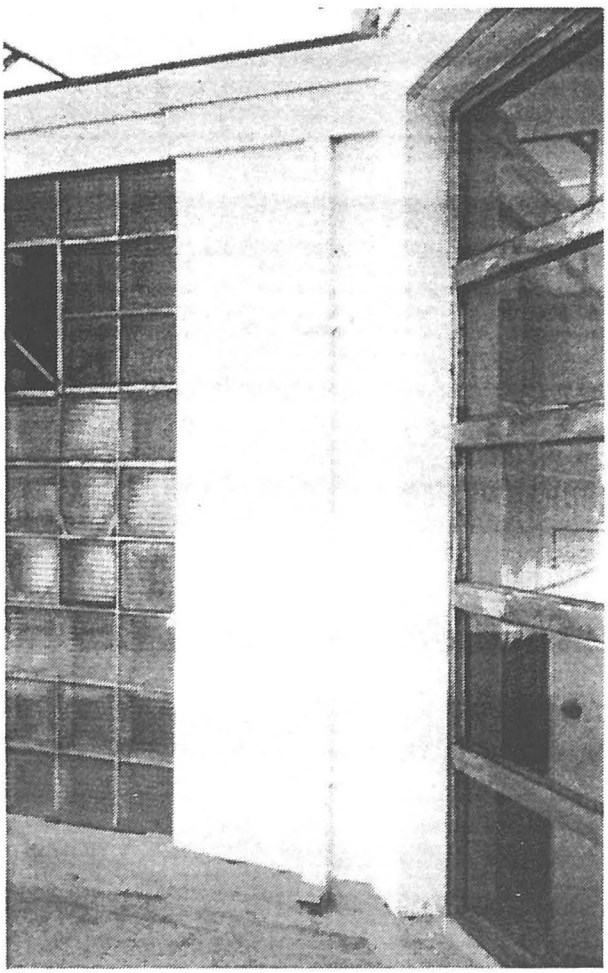


Third floor pantry under construction. Photo by ARG.



Water in third floor pantry glass block. Photo by ARG.

Junction of pantry and third floor. Photo by ARG.

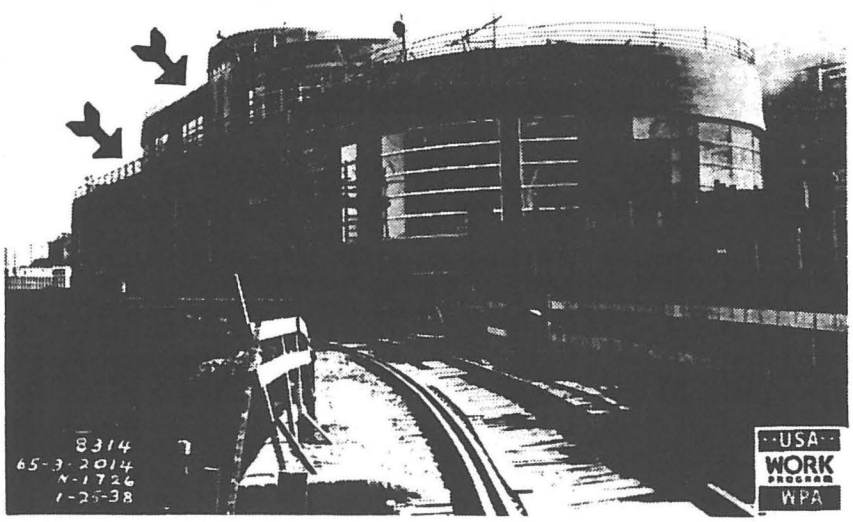


THIRD AND FOURTH FLOOR OBSERVATION DECKS

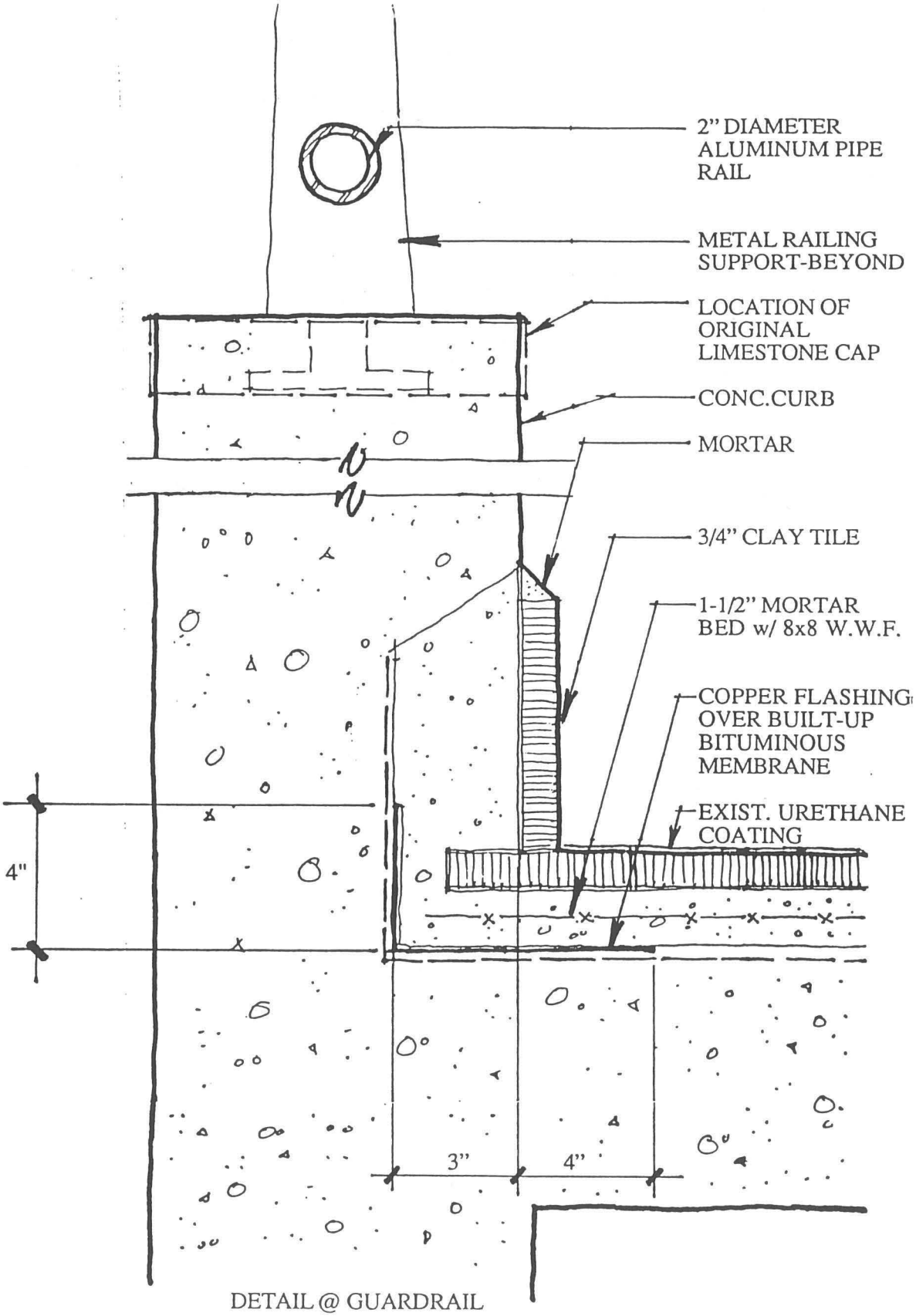
Description

The third and fourth floor observation decks are paved with 7-inch x 15-inch fired clay tiles set in an oblique herringbone pattern. There is currently a gray urethane deck coating applied over the tiles.

The original deck remains in place and consists of a built-up bituminous membrane applied over the reinforced concrete slab, followed by an 1 - 1/2 - inch mortar bed with wire mesh into which the tiles are set. At the deck perimeters, copper flashing is installed between the membrane and mortar bed, and is turned up within the parapet wall (the drawing on the following page indicates the existing conditions of the observation decks).



Bathhouse under construction. Third and fourth floor roof decks noted.



DETAIL @ GUARDRAIL

Condition

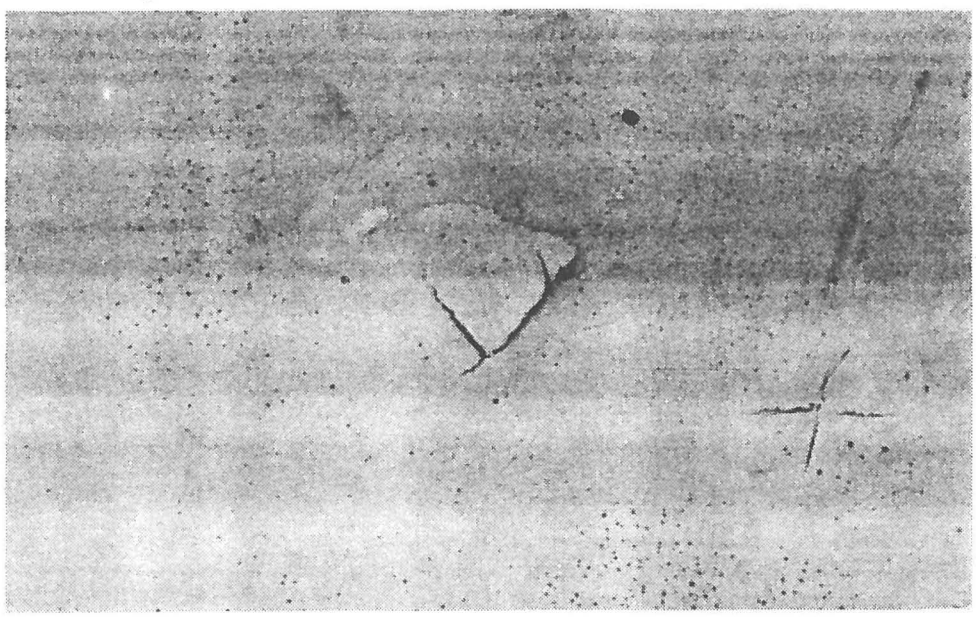
Water infiltration through these decks into the building has been a problem for many years as noted previously under MAINTENANCE HISTORY. There are several areas in the second and third floor interiors of water damaged plaster.

A general survey of the decks was made in order to identify areas where water was likely to penetrate. Damaged or cracked tiles and curbs were difficult to identify as conditions were hidden by the urethane coating. There were several areas where curb damage was obvious, due primarily to expansion of corroding steel imbedded in the concrete. Locations where loose urethane coating was removed during the repair work were examined in order to determined the condition of the pavers. Cracks were noted through tiles and in mortar joints. It was not possible to definitely correlate damaged areas of the roof with areas of water leaks within the building. This suggests that water may be traveling some distance within the building assembly before it appears on interior walls and ceilings.

Drains were identified as a possible source of water infiltration and were checked for possible leaks as part of the repair work. Water was run through each drain for thirty minutes, and spotters were positioned inside the building. No evidence of water penetration was noted. Crawl spaces in the building in which the unfinished underside of the roof slabs are visible were inspected. In several areas, light colored water stains were observed at hairline cracks and anchors in the slab.

One excavation was made on the third floor deck near a perimeter curb to determine existing conditions. A small rectangular portion of the deck was removed down to the reinforced concrete slab revealing tile, cementitious mortar bed, built-up bituminous membrane, and copper flashing. All components appeared to be in good condition.

The failure of the roof decks cannot be proved by the condition of the materials in the area of the excavation, nor was it determined that leaking drains are at fault for water damage to interior plaster surfaces. It appears that failure was associated with the general cracking of the clay tiles which allowed water into the deck assembly, and from where it infiltrated into the building.



Blister in urethane coating which covers roof decks. Photo by ARG.

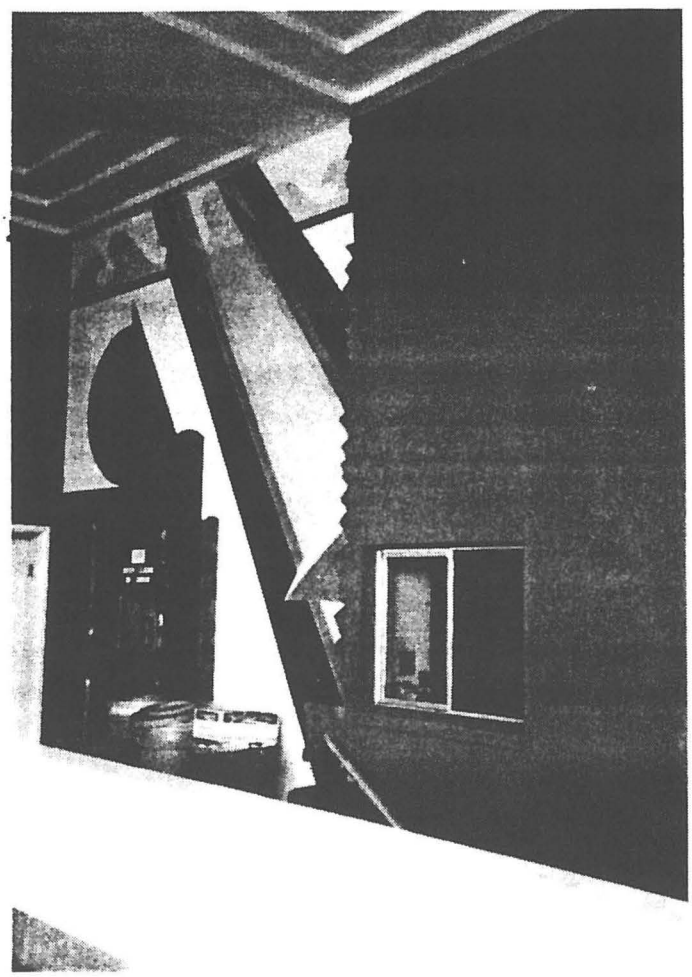
VERANDA TILE DECK AND DECORATIVE TILE WORK

Description

The veranda deck on the north elevation of the second floor is tiled with rectangular mosaic green and off-white colored tile, and applied to the south wall of the veranda are 4-inch square tiles of various colors which form a large mosaic. At the east end of the wall a large area of of the 4-inch tile is missing. A 1948 article about Aquatic Park in the San Francisco Chronicle mentions that one 14-foot x 17-foot mosaic mural was never finished, which may explain the current condition.

Condition

The deck is in good condition with no significant damage. The tiles appeared to be well adhered to the wall, and are in generally good condition with the exception of tiles which have a metallic luster glaze many of which have changed color due presumably to oxidation.



Incomplete tile mural on veranda exterior wall. Photo by ARG.

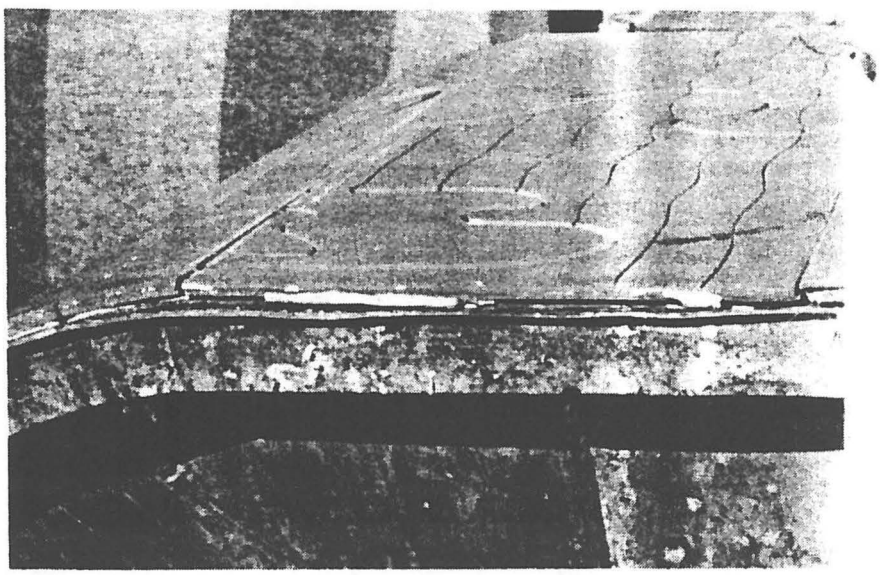
COPPER ROOFS

Description

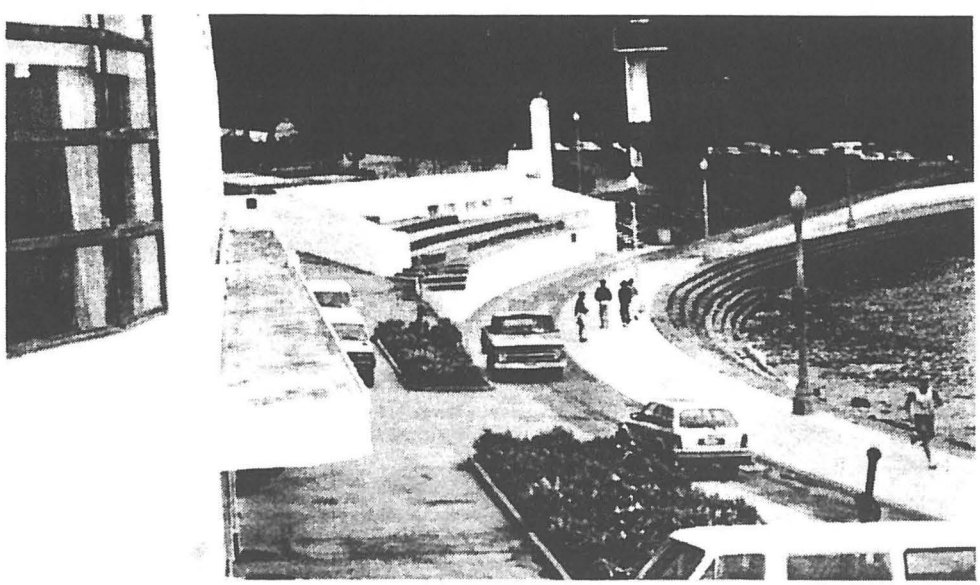
The Beach Street entrance canopy, the canopy over the north elevation entrances, and a small pitched roof over the stairs between the third and fourth floors on the south side of the building, are lead coated copper. The entrance canopy and the veranda copper have flat seams, and the pitched roof copper has standing seams.

Condition

These roofs appeared to be in generally good condition. The copper cap flashing along the front edge of the canopy was loose.



South elevation entrance canopy copper roof showing open joint and loose cap flashing. Photo by ARG.



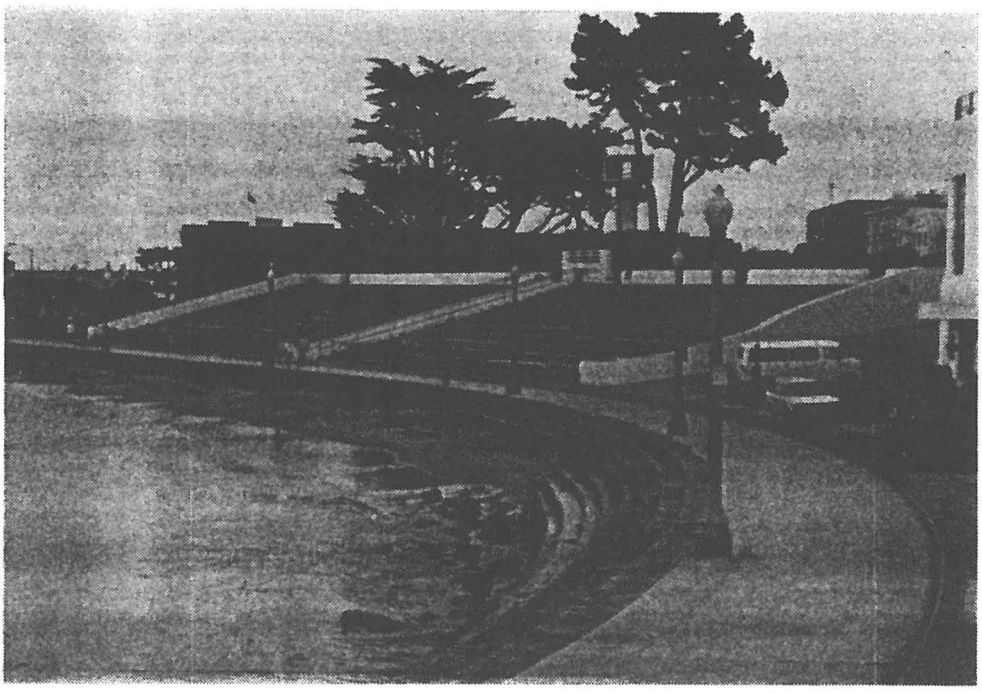
North elevation copper roof. Photo by ARG.

BLEACHERS

Description

Three sets of reinforced concrete bleachers adjoin the museum building; two to the east and one to the west. The finished spaces of the east and west wings of the first floor are beneath portions of the two sets of bleachers next to the building. The space beneath the eastern-most bleacher is essentially unfinished, and was until recently used for storage. It is now converted to a workshop. It has minimal electrical service, but no HVAC system.

The construction of the bleacher is similar to that of a stairway with reinforced concrete treads and risers. Over the concrete treads and risers is a 4-ply bituminous membrane, followed by a 1-1/2 to 2 -inch thick concrete topping which is also reinforced. The topping is coated with cement plaster parging (the drawing on the following page indicates the existing conditions of the bleachers).



Bleachers east of the museum building. Photo by ARG.

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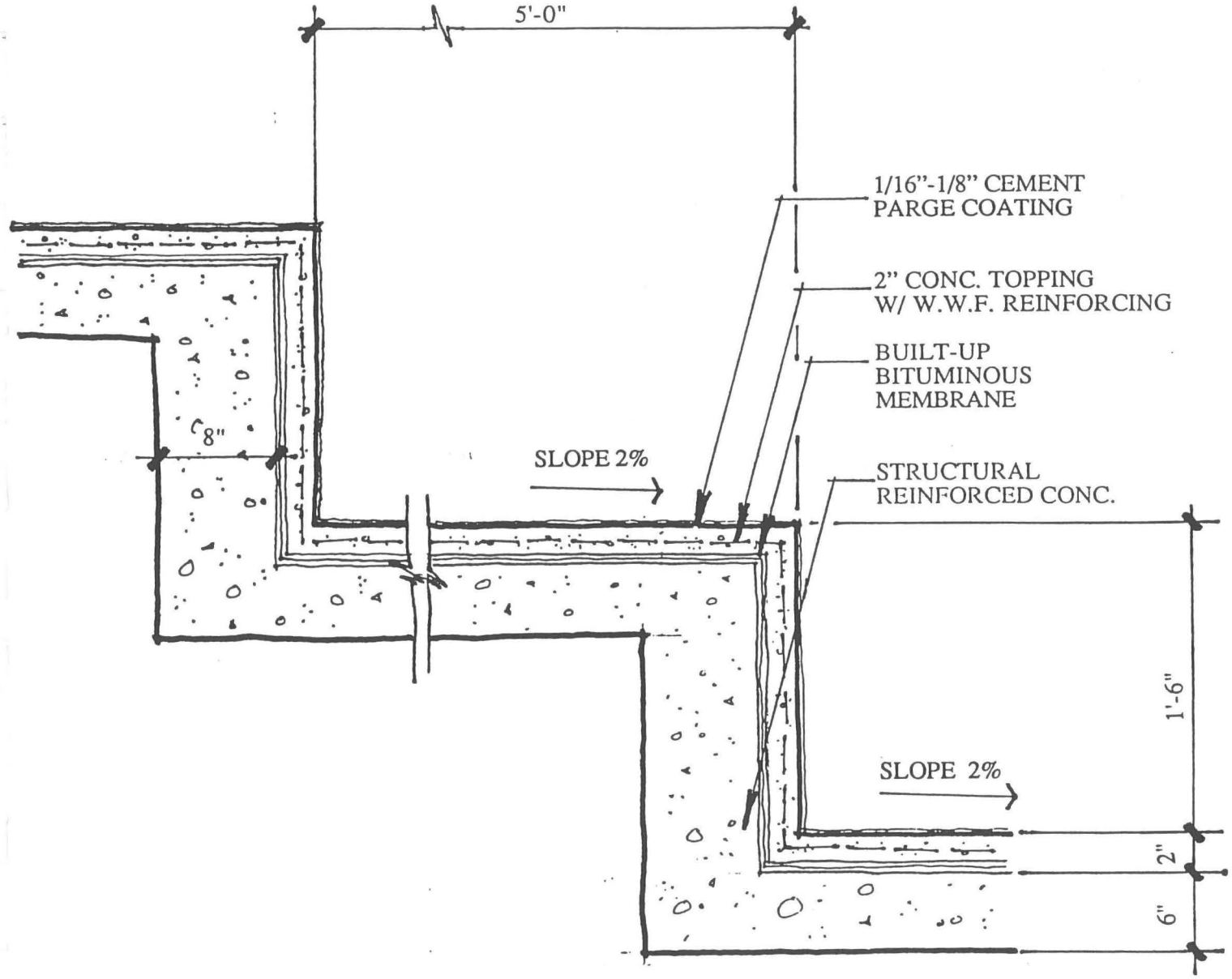
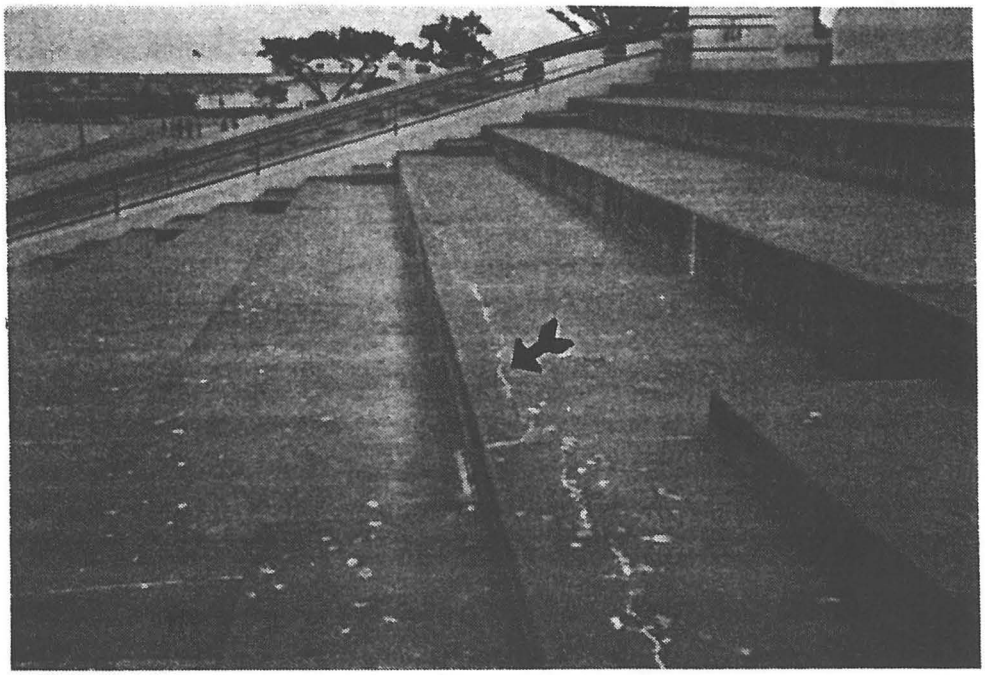
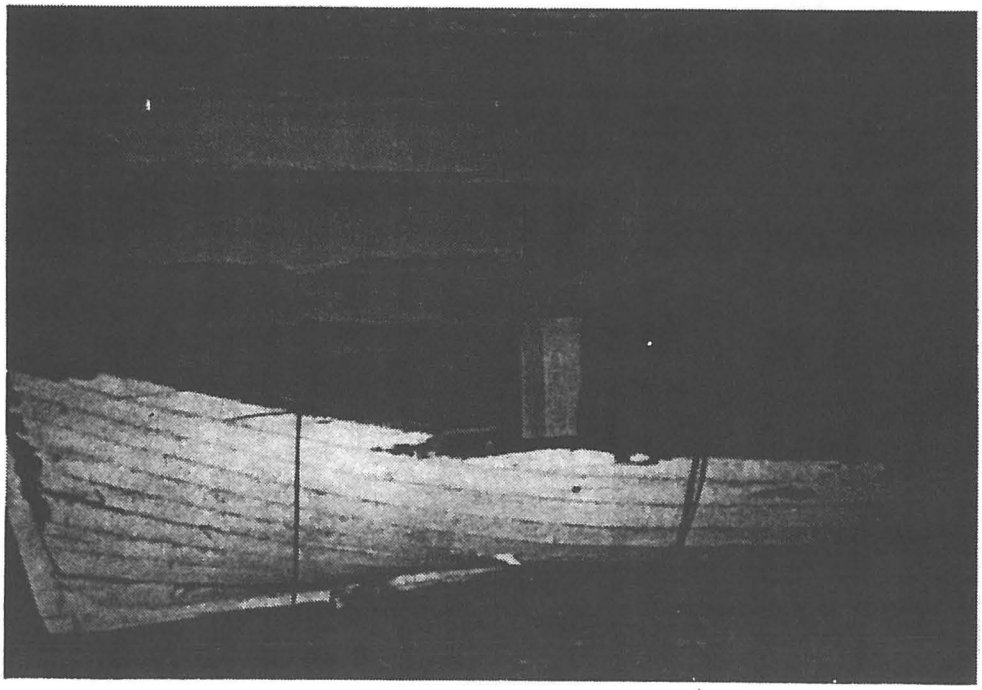


EXISTING BLEACHER DETAIL

some damage. There was no significant difference between exposed surfaces of the three bleachers; cracks and spalls were noted on each. This suggests that moisture is penetrating all of the bleachers to some degree, and that deterioration will continue.



Failed sealant in cracks of bleacher. Photo by ARG.



Spalled concrete under easternmost bleacher. Photo by ARG.

DRIVEWAY RAMPS

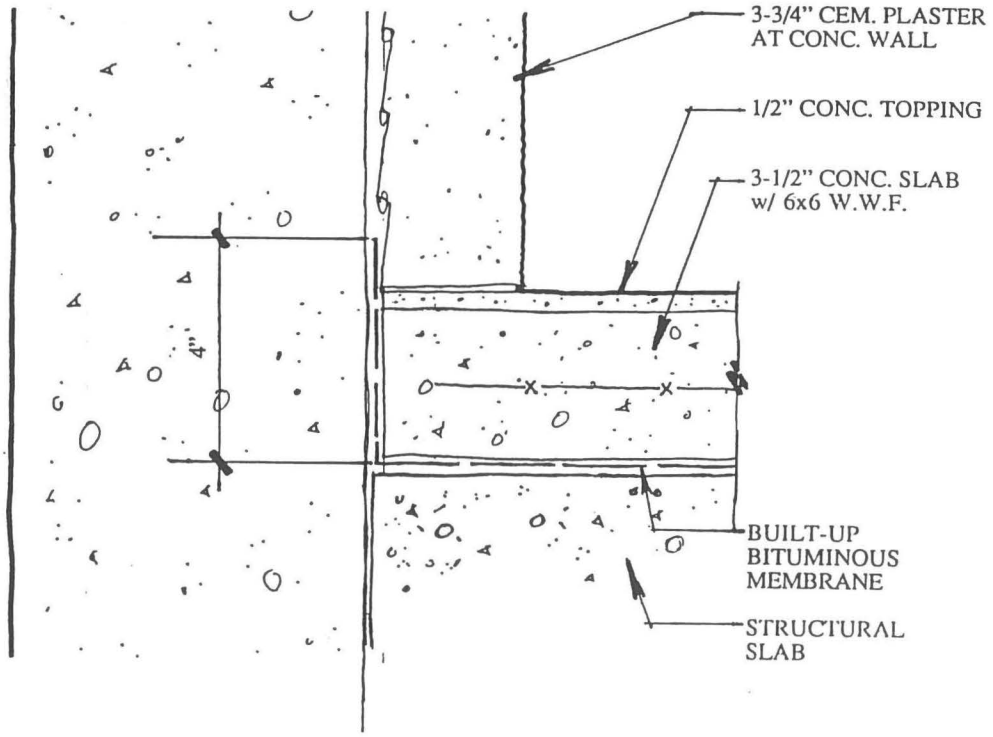
Description

The above ground portion of the building and the bleachers to the east and west are separated by driveways which connect the Beach Street side of the building with the Bay side.

One excavation was made in the east side driveway adjacent to the building wall. Beneath a 1/2-inch concrete topping was a 3-1/2-inch concrete slab with 6 x 6 wire reinforcement. This slab was laid over a built-up bituminous membrane which in turn was applied over the structural slab (see drawing below).

Conditions

The driveways have numerous cracks as well as open joints at the junction of the driveway and building, and driveway and retaining walls. There have been attempts to seal some open joints, but the sealant has deteriorated and now provides no protection. Beneath the east end driveway, water has entered the offices of the museum curatorial staff. It appears quite likely that the path of entry is through the open joint at the junction of the museum building wall and driveway, and that the membrane itself is functional.



RAMP AT BUILDING DETAIL

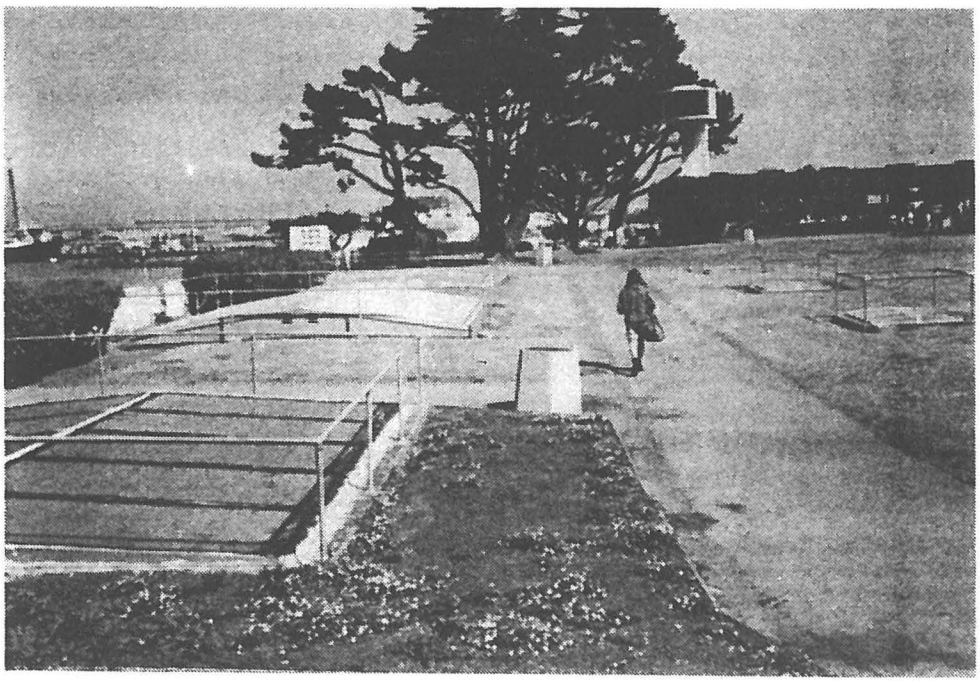
SKYLIGHTS AND SUBTERRANEAN ROOFS

Description

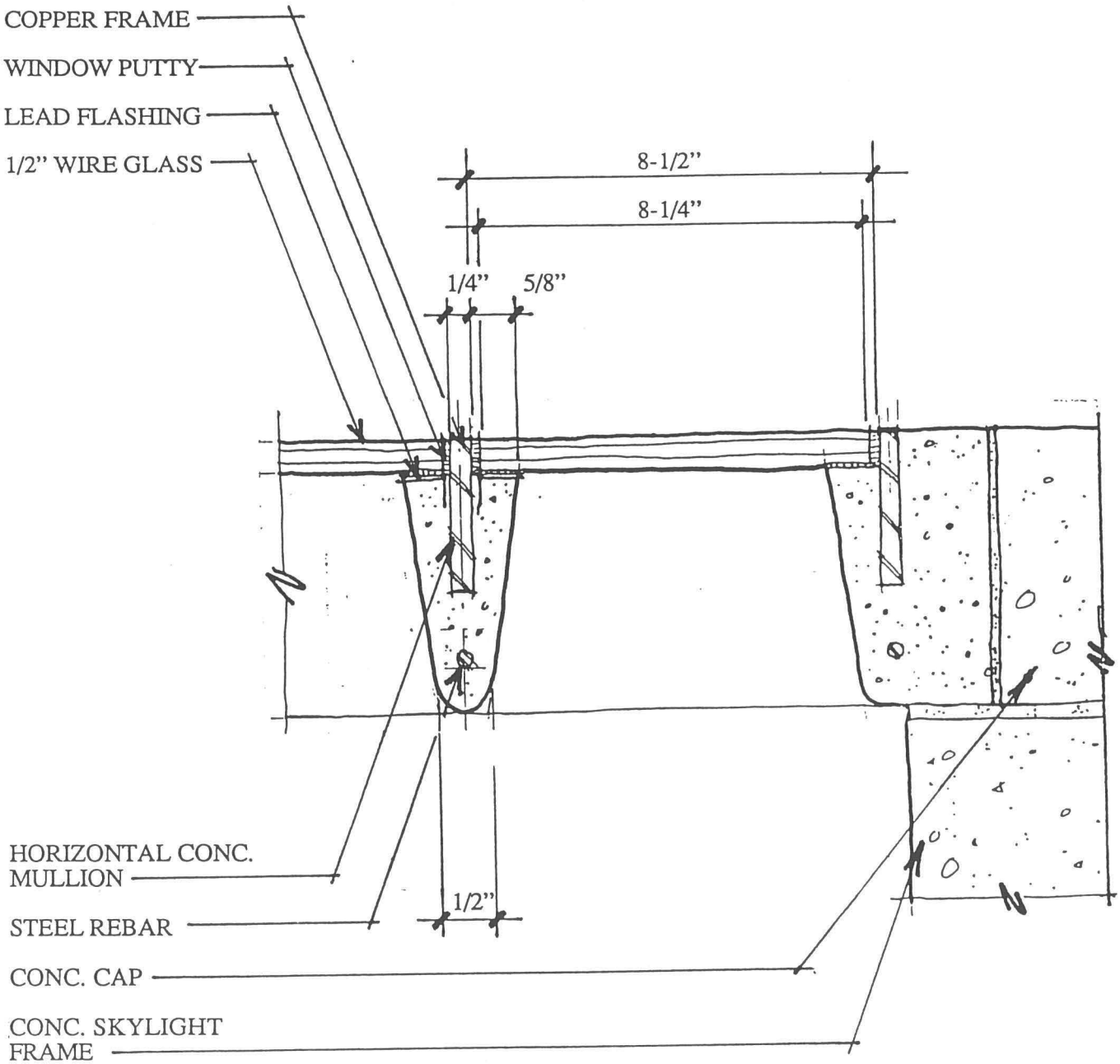
The subterranean roofs are those roofs south of the bleachers and beneath grade which have been back-filled with soil and are currently planted. Skylights in the roofs provide light to various underground spaces and are constructed of cast reinforced concrete grid-works fitted with 1/2-inch thick, 7-inch square wire glass lites (see detail on page 23). Due to leakage both around lites and at perimeters, each of the skylights was retrofitted before 1989 with a low pitched cover constructed of translucent plastic panels in aluminum frames. These un-vented covers created condensation, and apparently did not solve the leaking problem. In 1989 two skylights covers, one on the east and one on the west side of the museum building were installed. These new covers appear to have successfully stopped water infiltration. Railings have been positioned around all of the skylights to keep pedestrians off the units.

One excavation was made adjacent to a skylight curb at the north end of the building. The depth of soil was approximately 2-feet. Beneath the soil was a 4-1/2" thick layer of concrete laid over a built-up bituminous membrane which in turn was placed over the structural slab. The base of the skylight curb was brick with an elastomeric coating suggesting that an attempt was made to waterproof the curbs somewhat recently (see detail on page 24).

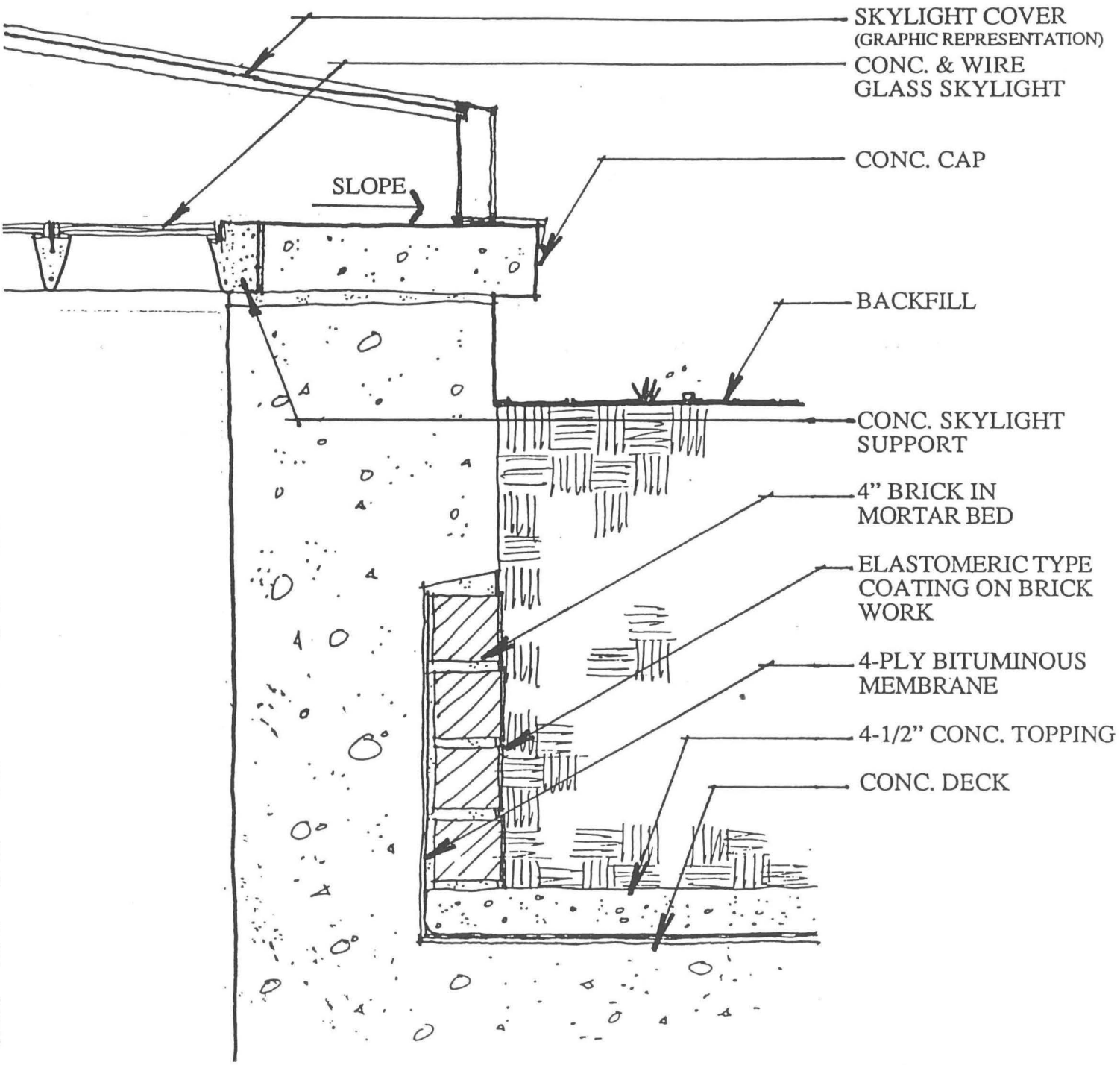
Original plumbing drawings show drains for these roof decks which emptied into the bay, and a construction photo confirms that the drains were installed (see page 26). The end of the drains remain visible in the seawall, and water was noted running out of a number of the drains during the survey.



Skylights east of museum building. Photo by ARG.



SKYLIGHT DETAIL



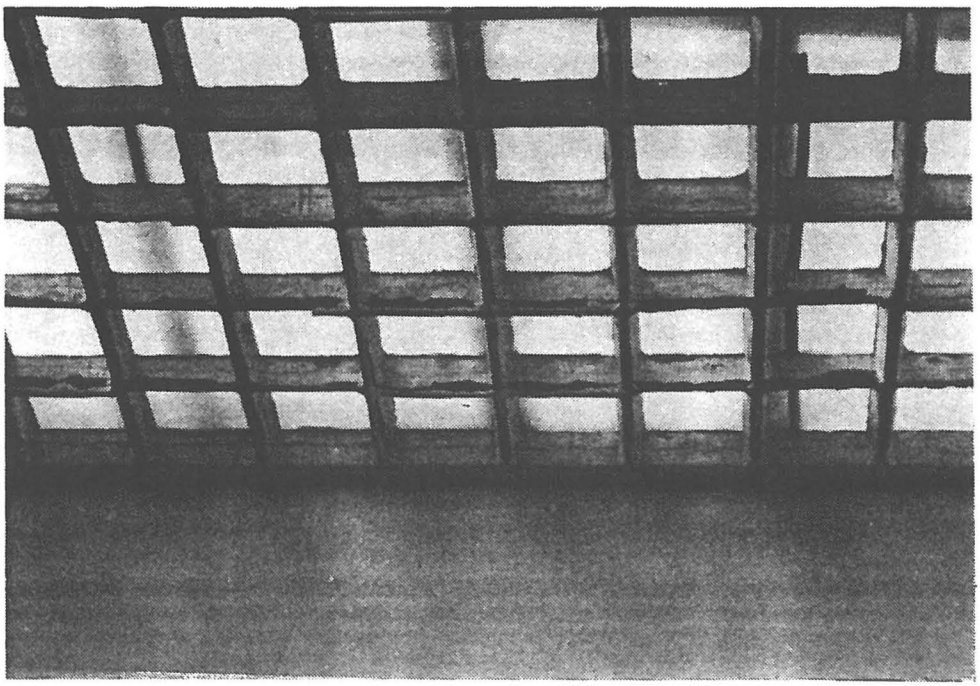
EXISTING DETAIL AT SKYLIGHT

Conditions

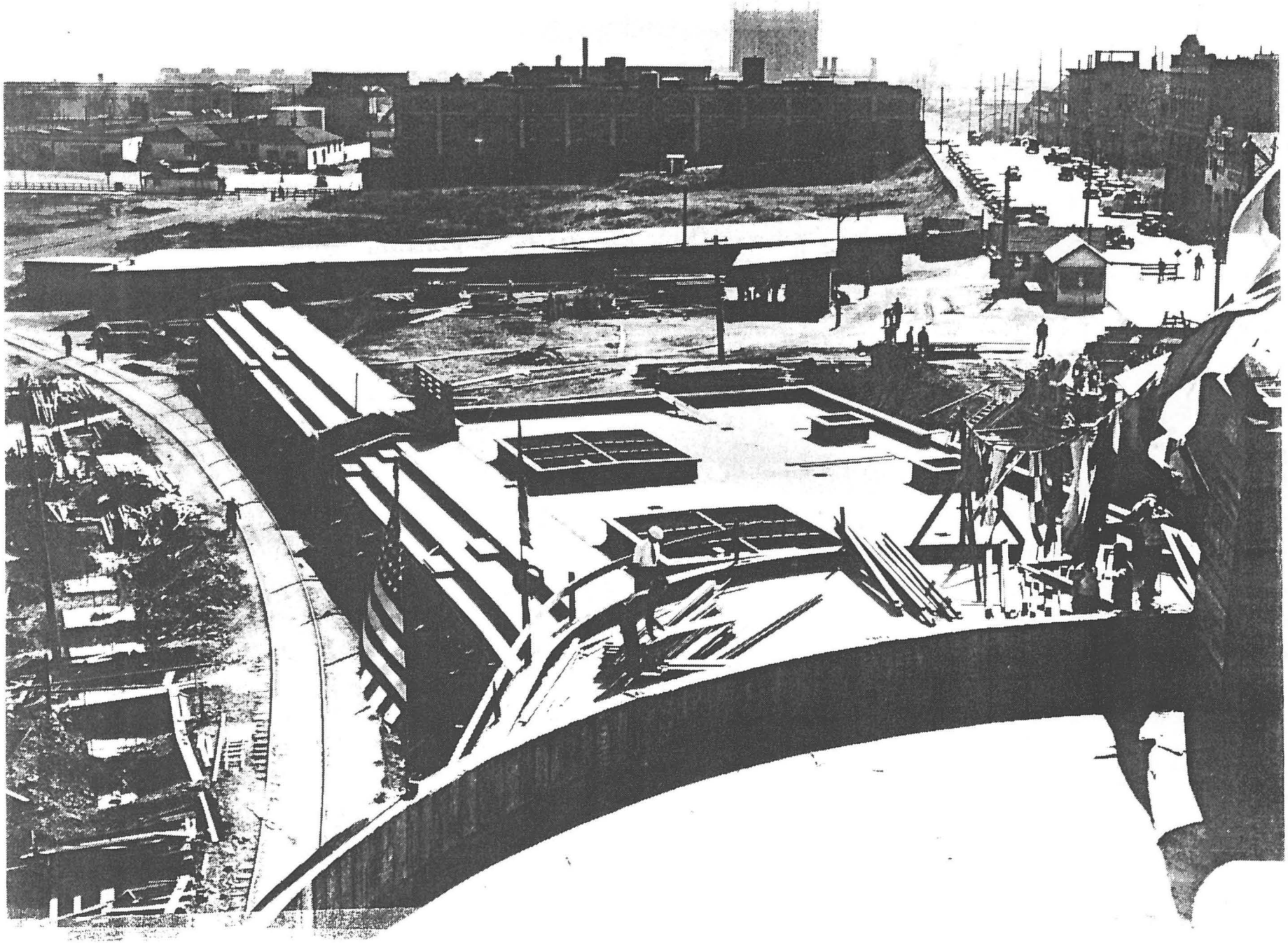
When inspected from the interior, it appeared that all of the skylights had leaked at some time in the past directly through the glass lites, and at the concrete curbs. Green biological staining remains on several interior curb walls, and the majority of wire glass lites were cracked and discolored. Spalling of the concrete frames, caused by corrosion of reinforcing steel, was common. Condensation was prevalent on glass and plastic surfaces in the air space between the original skylights and the skylight covers with the exception of the newer covers which appeared to have adequate ventilation. NPS personnel familiar with the condition of the subterranean space report that the new covers have been successful in preventing water from entering the building through the skylights they protect.

There were also two major leaks in subterranean spaces other than at skylights. In the Senior Center ceramic and weaving room of the west wing there is a leak on the below grade south wall at a location where conduits penetrate the concrete. Above the location of this leak on the exterior of the building, a large open construction joint was observed in the concrete. It is very likely that this open joint is the major, if not the sole source of the leak. Insects were noted at both the open joint and at the interior leak.

The other leak is at a similar location in a storage area of the east wing. It too is against an exterior below grade wall which runs parallel to Beach Street. The area above this leak on the exterior of the building was inspected, and some open joints were noted; however there were no joints directly corresponding to the leak location. Open joints at the junction of building elements are more difficult to detect on this side of the structure as grade changes have been made so that the original retaining walls are now covered with soil.



Spalling of skylight concrete gridworks frames. Photo by ARG.



Subterannian roof deck east of museum building under construction.

PART II - OPTIONS AND RECOMMENDATIONS

INTRODUCTION

In this section treatment recommendations are discussed. In instances where more than one treatment may be considered it is presented as an option. Conceptual cost statements for recommendations and options are also provided. These figures are preliminary, and are in advance of plans and details for the work recommended. The cost statements are for budgeting purposes only.

In addition to this report, ARG prepared specifications and drawings under this contract for restoration of the penthouse. This work would include application of a new roof membrane and restoration of the windows and exterior doors. The roofing system to be used is a rubberized asphalt surfaced with terra cotta tile as recommended below, and the windows will be restored as per documents previously prepared by ARG. The penthouse project if undertaken will serve as a test for these restoration treatments so that an evaluation of application and design may be made prior to their use on the entire building. In the writing of this report, it has been assumed that a final decision has not been made regarding the penthouse project.

EXTERIOR WALLS

The reinforced concrete walls have been painted within the last two years and are in good condition with no major repairs necessary. As mentioned, a scope of work for restoration of the Museum Building windows has been defined under a previous contract between ARG and NPS. This project will include minor repair of concrete at window jambs and adjacent surfaces in conjunction with restoration of the windows. Repair of the one large spall on the north wall of the penthouse is also included in this scope of work.

Damaged vent grills positioned between the first and second floors should be replaced with grills matching the original grill design. Since these repairs are small, hiring an outside contractor to perform this work would not be cost effective. The repairs could either be included in the window restoration project, or performed by NPS maintenance personnel.

In conjunction with the next painting of the building, minor losses at random locations, and the large area of loss on the west end of the museum building should be patched.

SECOND FLOOR ENTRANCE SURROUND AND FOUNTAINS

A complete investigation of the condition of the entrance surround and fountains was beyond the scope of this study. In general, a more thorough investigation, including exploratory probing to determine existing conditions of concealed areas and analysis of deteriorated materials is recommended. It was not possible without further study to develop cost projections.

Option - No Treatment

If the entrance surround and fountain is not stabilized or treated, it will continue to deteriorate and this important artwork will sustain significant damage. Although the various masonry components of the work are essentially intact at this time, many are not secure, and will likely be either stolen, vandalized, or broken in the near future. The large panels attached to the building walls which have visibly moved present a safety hazard as it is common for pedestrians to sit on the fountain walls beneath the panels.

Option - Salvage

The loose or broken pieces of masonry which are in danger of being lost by theft would be removed and safely stored. This applies essentially to the fountain coping stones.

The Salvage option represents the minimum amount of work which should be done at this time. Unfortunately, salvage of loose masonry will leave back-up masonry exposed to the weather which may in turn cause additional damage. Some type of replacement unit, or protection should be installed in those locations where loose masonry has been removed.

Option - Stabilization

Under this option, loose units of masonry would be stabilized to prevent detachment. This would require use of adhesives to re-adhere broken pieces, and resetting of loose units in mortar. A mortar should be used which is not excessively strong so that should a restoration be implemented in the future, these units could be disassembled without damage. For stabilization of some wall panels, it may be possible to fabricate brackets anchored into the reinforced concrete walls which would prevent the panels from falling outward. The brackets should be made of a non-staining material such as stainless steel. Other loose masonry units, such as fountain coping stones would be removed and placed in safe storage if it were not possible to re-secure them in place. As water infiltration behind the units may be a contributing cause of panel detachment, joints should be sealed temporarily with backer-rod and a urethane sealant (silicon sealants should not be used as plasticizers may migrate into the masonry).

This option will help to remove the safety hazards now present because of loose units; however these treatments will be visually intrusive and are only temporary measures.

Recommended Option - Restoration

Due to the significance of this artwork, restoration is warranted. It will likely be necessary to essentially rebuild the sculpture and fountain by carefully removing individual units, repairing back-up masonry, and re-setting the slate and terrazzo. Repair of small losses and cracks will also be necessary. In conjunction with this work, analysis for proper conservation treatment should be conducted to determine the causes of discoloration and deterioration of the slate at edges. The plumbing should be inspected, and repaired as required so that the fountain may function as originally designed.

ENTRANCE STEPS

Option - No treatment

Open joints in the entrance steps will allow water penetration and associated damage.

Recommended Option - Cleaning and Pointing

The blotchy appearance of the steps is visually disruptive. It is recommended that the residue of the existing coating be removed, the granite cleaned and stains removed, joints pointed, and the steps left uncoated.

Outline of Work

I. Protection:
   A. Protect adjacent surfaces of fountain, entrance doors, and terrazzo sidewalk.
II. Preparation:
   A. Prepare small test panel using stripper to remove coatings and/or staining.
   B. Seal joints temporarily to prevent moisture penetration.
III. Removal:
   A. Remove coatings and/or staining.
IV. Pointing:
   A. Point open joints in masonry.

Cost Projection: $3,474.00

ENTRANCE CANOPY

Note: Treatments for slate and copper roofs are discussed in other sections; treatments for missing lites are discussed below.

Option - No treatment

Missing soffit panels have been filled with either glass not matching the original or plywood. Although the soffit is currently unsightly, there are no open areas and therefore the interior is protected from weather and pigeons.

Recommended Option - Restoration

It is recommended that glass matching the color and texture of the original glass be located and used to replace those panels which are not original. Some rehabilitation work on the metal gridwork may also be necessary.

Replacement of Glazing and Rehabilitation of Gridwork:

Cost Projection : $3,206.55

THIRD FLOOR PANTRY

Option - No Treatment

With no treatment, water will continue to enter open mortar joints and penetrate into the glass block units. The bow in the northeast side of the glass block is cause for concern. Although it appears that the roof of the penthouse is supported by steel columns, this condition, combined with the cracking of glass brick units, may indicate a structural problem in the wall which could worsen. In general, the glass brick wall of the pantry will continue to deteriorate if not treated.

Option - Temporary Stabilization

This option would involve sealing open mortar joints to prevent further penetration of water into the wall. As this is a temporary treatment, a sealant, which would be easier to apply than mortar could be used in the joints in conjunction with a bond breaker. A sealant should be used which can easily be removed from glass surfaces in the future.

Outline of Work

I. Protection:
   A. Protect roof deck.
II. Preparation:
   A. Rake joints.
   B. Apply bond breaker.
III. Seal:
   A. Seal joints with elastomeric sealant.

Cost Projection: $7,828.00

Recommended Option - Replication

Because there is significant damage to the glass wall units, as well as bowing which suggests structural problems, it recommended that the wall be disassembled and rebuilt using glass block units which match the color, texture and size of the original units. Although it would be preferable to re-use the original blocks, this approach is not advocated for the following reasons:

There is the distinct possibility that those existing blocks which currently appear to be in good condition may have the same or similar defects which have allowed water to infiltrate some units. Thus, should the wall be rebuilt with some original materials, it is quite possible that water infiltration of blocks would reoccur.

There is also the problem of mixing original blocks with replacements. Although it may be quite possible to find a match to the size of the block, because of changes in manufacturing techniques, the color and texture of the original and replacement units will not be a perfect match. A noticeable visual disruption would result if original and new blocks were used side-by-side in the rebuilt wall.

A photograph taken during construction of the pantry shows that the roof is supported independently of the walls, and that the blocks were laid-up after the roof had been constructed. It may therefore be possible to remove the existing block and rebuild the wall without significantly affecting the roof.

As the pantry was an afterthought, and may not have been built to the same standards as the rest of the structure, it is recommended that the pantry design be examined by an engineer. Representative samples of original blocks of various condition should be cataloged and accessioned into the collection of the National Maritime Museum.

Outline of Work

I. Protection:
   A. Protect roof deck and adjacent reinforced concrete walls.
   B. Protect interior exhibit spaces.
   C. Protect ductwork.
II. Demolition:
   A. Remove existing exhibit walls necessary to perform the work.
   B. Remove existing glass block and salvage window frames.
   C. Salvage block as required by NPS.
III. Preparation:
   A. Prepare block curb by repairing spalls and other deterioration.
   B. Clean and paint steel columns and beams.
IV. Install Glass Block
   A. Lay glass block in mortar. Blocks and mortar to match original.
V. Rebuild/Reinstall Exhibit Walls

Cost Projection: $79,218.00

THIRD AND FOURTH FLOORS OBSERVATION DECKS

Option - Continued Maintenance

The existing urethane coating would continue to be patched as necessary by NPS maintenance staff. This will help in preventing water from entering the building and damaging interior finishes. The maintenance staff should also keep roof drains and scuppers clear, and make periodic inspections of the roof. This option is obviously not a permanent solution to the problem, and it is quite likely that leaks will continue to develop in the decks.

Option - Restoration

Restoration, in which the urethane coating would be removed and the existing tiles repaired, is unfortunately not a viable option. The fired vitreous surface of the tiles has been removed by sandblasting, revealing a porous surface which is not an acceptable deck surface. Moreover, the survey results, as well as history of repairs, indicate that the deck is in general no longer water-tight and cracking of tiles is prevalent.

Recommended Option - Replacement

It is recommended that the existing deck be removed down to the roof slab and replaced using a floor tile matching the color, texture, and size of the original. A suitable replacement tile is available from Gladding, McBean of Lincoln, CA.

Two alternatives for replacement of the original membrane have been identified: urethane and rubberized asphalt. For application of either membrane it would be necessary to remove the existing membrane and clean the reinforced concrete slab. If a urethane system were chosen, it would be critical for performance of the new membrane that all trace of the existing asphalt be removed. As the rubberized asphalt system and the existing membrane are not incompatible, the cleaning of the slab would not need to be as thorough. The rubberized asphalt system is roughly twice the cost of the urethane, however part of this price differential would be offset by the cost of extra cleaning and site supervision necessary for application of the urethane.

The high standard of cleaning which must be maintained for successful application of the urethane makes use of this system problematic. If any residue of asphalt remained the waterproofing characteristics of the membrane could be affected. Also, from a historic preservation point of view, it is desirable to use a system as close to the original as possible, and the rubberized asphalt fulfills this requirement.

For the purpose of testing the proposed roofing system for the second and third floors observation decks, it is recommended that the system be installed first on the penthouse roof. In this way potential design problems would be identified and corrected prior to re-roofing of the entire structure.

Outline of Work

I. Protection:
   A. Protect exterior walls and windows adjacent to the roof decks.
II. Demolition:
   A. Remove existing tiles, setting mortar, and membrane.
III. Preparation:
   A. Clean existing slab.
   B. Repair cracks in slab.
IV. Installation:
   A. Apply asphalt membrane.
   B. Apply clay tiles set in mortar bed.
   C. Apply protective elastomeric coating to curbs.

Cost Projection for Rubberized Asphalt:	$452,195.00
Cost Projection for Urethane:	$461,621.00

PENTHOUSE ROOF

Option - Continued Maintenance

The penthouse roof, which also has a urethane coating over an original concrete topping, could be patched by NPS maintenance staff, but this is only a temporary solution and it is likely that leaks would continue to develop.

Option - Restoration

This roof is not accessible to the public and there are no historically significant materials which warrant restoration.

Recommended Option - Replacement of Original Membrane

The same points discussed under the Recommended Option for the Third and Fourth Floors Observation Decks apply for the penthouse roof. The existing membrane and concrete topping would be removed, and a rubberized asphalt coating applied. Instead of a concrete topping, terra cotta tile would be installed in a mortar bed so that the system would match that of the third and fourth floors observation decks, and therefore serve as a test for re-roofing of the entire structure.

Outline of Work

I. Demolition:
   A. Remove existing concrete topping, and membrane.
II. Preparation:
   A. Clean existing slab by sandblasting.
   B. Repair cracks in slab.
III. Installation:
   A. Apply asphalt membrane with insulation.
   B. Apply concrete topping.
   C. Apply protective elastomeric coating to curbs.

Cost Projection for Rubberized Asphalt: $52,846.00
Cost Projection for Urethane: $59,543.00

VERANDA TILE DECK

Recommended Option - No Treatment

As this deck is in generally good condition no treatment is necessary at this time.

COPPER ROOFS

Option - No Treatment

Although the copper roofs are in generally good condition, the loose cap flashing on the canopy roof will allow water into the interior of the canopy. This may cause corrosion of the steel framework and anchors, and may also eventually cause a short in the electrical circuit.

Recommended Option - Minor Repair

Joints in the copper roofs should be examined, and re-soldered if necessary. The loose cap flashing on the front of the canopy should be secured, and a sealant installed at the junction of the flashing and the masonry panels. Drains in copper roofs should be checked and cleared at this time if necessary.

Outline of Work

I. Repair:
   A. Re-solder open joints.
   B. Apply Sealant where required.
   C. Clear drains.

Cost Projection for Repair: $2,610.00

BLEACHERS

Discussion

The evidence suggests that moisture, either as liquid or vapor, is penetrating into the bleachers from both the interior and exterior sides, and causing corrosion of reinforcing steel. It is likely that some damage to structural concrete is concealed by the topping. The best approach would therefore be to include treatment of both exposed and concealed concrete in one project so that all portions of the bleachers are properly repaired at once.

The fundamental problem in restoration of the bleacher waterproofing is that the failed membrane is sandwiched between the 2-inch concrete topping and the reinforced concrete structure. It is thus essentially inaccessible for repair or replacement without removal of the topping concrete. Alternatives to replacement of the existing bleacher membranes are problematic. One approach would be to repair surface defects such as cracks and spalls to reduce the amount of water reaching the topping, membrane, and structural concrete. Coating the entire surface with a protective coating to further reduce water infiltration could be included with this work. Treatments such as these are interim stabilization type measures as they will help to slow deterioration, but they do not address the specific problems of the failed membrane or concealed concrete damage. These treatments are, however, certainly worth considering if a total repair cannot be accomplished soon, and especially if the work could be done by NPS maintenance personnel.

It is unlikely that all leaks would be stopped by repair of surface defects or application of a coating. Further, a significant amount of maintenance would be necessary to preserve an applied coating. Cementitious protective coatings are available for use on concrete, as well as polymer deck toppings. Both cementitious coatings and deck toppings, while normally durable on flat surfaces, would probably not have a long useful life on the well-used bleachers because of inevitable break-down at intersections of the treads and risers. Also, the carving of initials, or heat from fires would damage polymer coatings.

The most logical repair scheme would be to remove the existing concrete topping, repair deteriorated concrete from both top and underside of the bleachers, replace the failed membrane with a rubberized asphalt membrane, and finally replace the concrete topping. The obvious drawback to this would be cost; however, any project which did not include this scope of work would be less than a complete repair. For the long term, this approach is justified and is recommended.

Two methods for concrete repair from the exposed underside of the bleachers are shown in Appendix B. The first, Alternate A, Detail 5, would involve removal of all damaged concrete, repair of steel, and application of new concrete to replace that removed, as well as additional concrete with re-bar at outside corners. The new concrete may either be placed using form-boards to duplicate the original appearance, or spray applied. Spray application would likely be the cheapest method.

The second method, Alternate B, shown in Detail 6 in Appendix B, would involved repair of existing concrete and re-bar, but new steel members would be applied to the underside of the bleachers to provide additional strengthening instead of concrete as shown in Detail 5. The advantage to this method when compared to Alternate A is that less weight would be added to the bleachers. The disadvantage is that the protective coating on the steel would have to be well maintained in the aggressive bay-side environment to prevent corrosion of the steel.

A third extreme repair approach, total replacement, may be necessary should it be revealed in the course of work that the concrete was severely damaged. This would involve shoring, demolition of the damaged section, construction of formwork, and placement of new concrete.

It was not possible for this report to determine the extent or severity of concrete deterioration as exploratory demolition would have been necessary from both sides of the slab in a number of locations in all three bleachers. Accordingly, costs for repair of the bleachers, especially for concrete repair, were difficult to project. The "Repair of Damaged Concrete" option outlined below assumes that the work would be a straight-forward treatment of spalls and reinforcing steel using methods such as Alternate A or B. The option "Investigation of the Degree of Corrosion to Reinforcing Steel," assumes a worse case scenario, and the figure given is for order of magnitude budgeting only. It is based upon the assumption that demolition and replacement of portions of the concrete bleachers is required. The option figure covers exploratory demolition in each bay and at girders and perlins to reveal corroded steel. The option also includes costs for extensive shoring, but the costs for repair are not covered as the repair treatments cannot be determined until the investigation is completed.

In order to determine the appropriate repair option further structural evaluation will be required, and other repair drawings may be necessary in addition to those provided in this report. Projected uses of both interior spaces and exterior portions of the bleachers should be considered when repairs schemes for the bleachers are developed. On the basis of the information gathered to date, it appears that it would be best to repair all damaged interior concrete prior to installing a new membrane. Concrete repairs may result in minor localized movement of the bleachers. If the new waterproofing were already in place, movement of the substrate could cause a tear or separation in the membrane.

Options

Option - No Treatment

If the bleachers are not treated the reinforced concrete will continue to deteriorate, and the bleachers may become unsalvageable. Repair costs will likely rise in proportion to the length of time the bleachers are left untreated.

Option - Repair of Surface Defects

Under this option, expansion joints would be sealed with an elastomeric sealant, spalls would be repaired, and cracks grouted. For treatment of expansion joints, all existing sealant would be removed, the joint cleaned, backer-rod installed, and the sealant applied. Spalled areas would be chipped away to sound material, corroded steel sandblasted and coated, and a cementitious patching material applied. Cracks would be widened to at least 1/4-inch and grouted with a cementitious grout.

Outline of Work

I. Preparation:
   A. Expansion Joints
      1. Remove existing sealant and debris from joints.
      2. Insert backer-rod
   B. Cracks
      1. Remove sealant and debris from cracks, and widen narrow cracks to

minimum of 1/4".

C. Concrete Surfaces
   1. Clean concrete surfaces for painting.

II. Installation:
   A. Expansion Joints
      1. Install sealant
   B. Cracks
      1. Install grout
   C. Concrete Surfaces
      1. Coat concrete

Cost Projection for all three bleachers: $177,687.00

Recommended Option - Replacement of Existing Membrane

Outline of Work

I. Demolition:
   A. Remove existing concrete topping and railings.
   B. Remove existing asphalt membrane.
II. Preparation:
   A. Clean existing slab by sandblasting.
   B. Repair cracks in slab.
III. Installation:
   A. Apply rubberized asphalt membrane.
   B. Apply new concrete topping.

Cost Projection for all three bleachers: $798,603.00

Option - Repair of Damaged Concrete

Outline of Work

I. Demolition:
   A. Cut out all cracked, bulged, or otherwise damaged concrete back to sound material.
II. Preparation:
   A. Clean corrosion from exposed steel by sandblasting. Replace steel if 25% of section has been lost.
III. Repair:
   A. Replace steel if 25% of section has been lost due to corrosion. Paint steel with two coats epoxy coating
   B. Apply concrete patching compound using form-boards.

Cost Projection for all three bleachers per : $316,577.00

Option - Investigation of the Degree of Corrosion to Reinforcing Steel

Outline of Work

I. Protection:
   A. Install temporary shoring with inspection holes in bays showing significant corrosion of the steel.
II. Demolition:
   A. In four locations per bay, chip away concrete to expose slab steel.
   B. At selected locations at girders and purlins, chip back concrete to expose stirrups and top and bottom of reinforcing steel in these beams.
III. Preparation:
   A. Dry pack exposed areas with epoxy grout.

Cost Projection for all three bleachers: $497,048.00

DRIVEWAYS

Option - No Treatment

If the driveways are not treated, water will continue to leak into the office spaces beneath the driveways, and additional leaks may develop. Although the membrane was found to be in serviceable condition, continued penetration of water will cause deterioration.

Option - Replacement

The driveway concrete and membrane would be removed and replaced.

Work Outline
I. Demolition:
   A. Remove existing concrete topping.
   B. Remove existing asphalt membrane.
II. Preparation:
   A. Clean existing slab by sandblasting.
   B. Repair cracks in slab.
III. Installation:
   A. Apply rubberized asphalt membrane.
   B. Apply new concrete topping.

Cost Projection: $73,483.00

Recommended Option - Stabilization and Repair

The driveways are salvageable, and can be made watertight with proper sealing of joints and epoxy grouting of cracks. As part of the repair, an expansion joint should be cut down the center of the eastern driveway along the existing crack to allow for movement.

Work Outline

I. Repair:
   - A. Expansion Joints
     1. Install sealant
   - B. Cracks
     1. Install epoxy grout

Cost Projection for both driveways: $24,900.00

SKYLIGHTS

Option - No Treatment

The original skylights are currently protected by covers which appear to have stopped most leaks. However, the gridwork reinforcing steel will continue to corrode due to the condensation caused by the older unvented covers. Leaks at curb perimeters will continue to allow water into offices and work spaces.

Option - Installation of New Skylight Covers

The two new skylight covers recently installed have performed well in stopping water leaks according to building users. The design of these covers incorporates proper ventilation so that condensation does not occur. The use of these types of covers for the remaining skylights is a viable option; however the covers could be considered an inappropriate addition to this historic building as they are visually intrusive, and conceal the original skylights.

The approximate cost of installation of one skylight in 1989 was $10,000.00. Based on this figure, retrofitting the remaining skylights would cost approximately $55,519.00.

Option - Restoration

Under this option, all existing covers would be removed and the skylights would be restored. This work would include removal of all glass lites and repair of the reinforced concrete gridwork which has suffered significant loss of material in some areas. Original lites in good condition, and new lites matching existing, would be reinstalled using a modern sealant. The skylights would remain uncovered as originally designed; however it would probably be necessary to keep the railings in place to prevent pedestrians from walking on the skylights. For the purposes of minimizing the visual impact of the railings, and to restore the original character of these areas of the park, shrubs should be planted around the skylights as shown in the historic photograph in Appendix D.

It appears that failure of the skylights was due in part to the breakdown of the sealant in the joints. The use of copper adjacent to the glass lites may have been a factor in the failure as most sealants do not adhere well to copper or its alloys. This remains a problem today for modern sealant, and difficulties with maintaining a watertight joint could be expected if the

skylights were restored. Further, it would have to be determined if the existing design met current codes for loading.

Outline of Work

I. Demolition:
   A. Remove skylight covers
   B. Remove glass lites
   C. Remove existing deteriorated concrete from gridwork back to sound material.
II. Preparation:
   A. Clean corrosion from exposed steel by sandblasting. Replace steel if 25% of section has been lost.
III. Repair:
   A. Replace steel if 25% of section has been lost due to corrosion.
   B. Apply concrete patching compound. Use forms if necessary to accurately reproduce original profile.
   C. When cured, coat concrete with protective coating.
   D. Install glass lites and seal joints.

Cost Projection for repair: $84,584.00

Recommended Option - Replacement

Under this option, the skylight gridworks and glass lites would be replaced with newly fabricated units matching the originals. A manufacturer of these types of skylights was located. The advantage of this option is that the new units would be less likely to develop leaks than restored units due to advances in design and materials. Shrubs should be planted as shown in the historic photograph in Appendix D.

Work Outline

I. Demolition:
   A. Remove skylight covers
   B. Remove skylights
II. Preparation:
   A. Prepare existing skylight curbs to receive new skylights.
III. Installation:
   A. Install new skylights

Cost Projection Replacement of all eight skylights: $133,579.00

SUBTERRANEAN ROOFS

Option - No Treatment

Leaks will continue and may worsen, and other leaks may develop.

Option - Grout Leaks, and Seal Joints

Leaks in the subterranean walls would be sealed using a urethane grout. Holes would be drilled through the concrete wall in the leak areas, and the grout pumped through the holes to fill the voids created by water erosion on the outside of the walls. The grout would fill the area of the leak, and thus prevent water from penetrating the wall. Any cracks or holes in the walls would also be grouted. Joints at grade would be sealed if accessible.

This option may stop existing leaks, but additional leaks could develop at other locations.

Cost Projection: $17,941.00

Recommended Option - Repair and Application of New Membrane

Soil and asphalt would be removed to expose the decks, and all joints and cracks properly sealed. Drains would be tested and repaired if necessary. The skylight curbs would be repaired if necessary. Repair of skylights and subterranean roofs should be coordinated. Geotextile would be placed over drains to prevent soil from washing into the drains, and the soil would then be back-filled.

The process of water leaking into the building at the locations mentioned may have eroded the soil around the leak area, and further contributed to the leaking. For these areas, a grout should be pumped through the wall cracks in order to fill the voids and consolidate the surrounding soil.

In conjunction with this work, a new landscape design should be developed for the site which is more sympathetic to the original scheme.

Outline of Work

I. Site Work:
   A. Remove existing soil.
II. Preparation:
   A. Clean roofs by sandblasting
   B. Repair Cracks
   C. Seal Joints
III. Installation:
   A. Install new rubberized asphalt membrane.
   B. Replace soil.

Cost Projection for both roof decks: $117,693.00

DECORATIVE TILEWORK

Option - No treatment

The tiles are in generally good condition, and except for the tiles with a metallic luster glaze, do not require treatment.

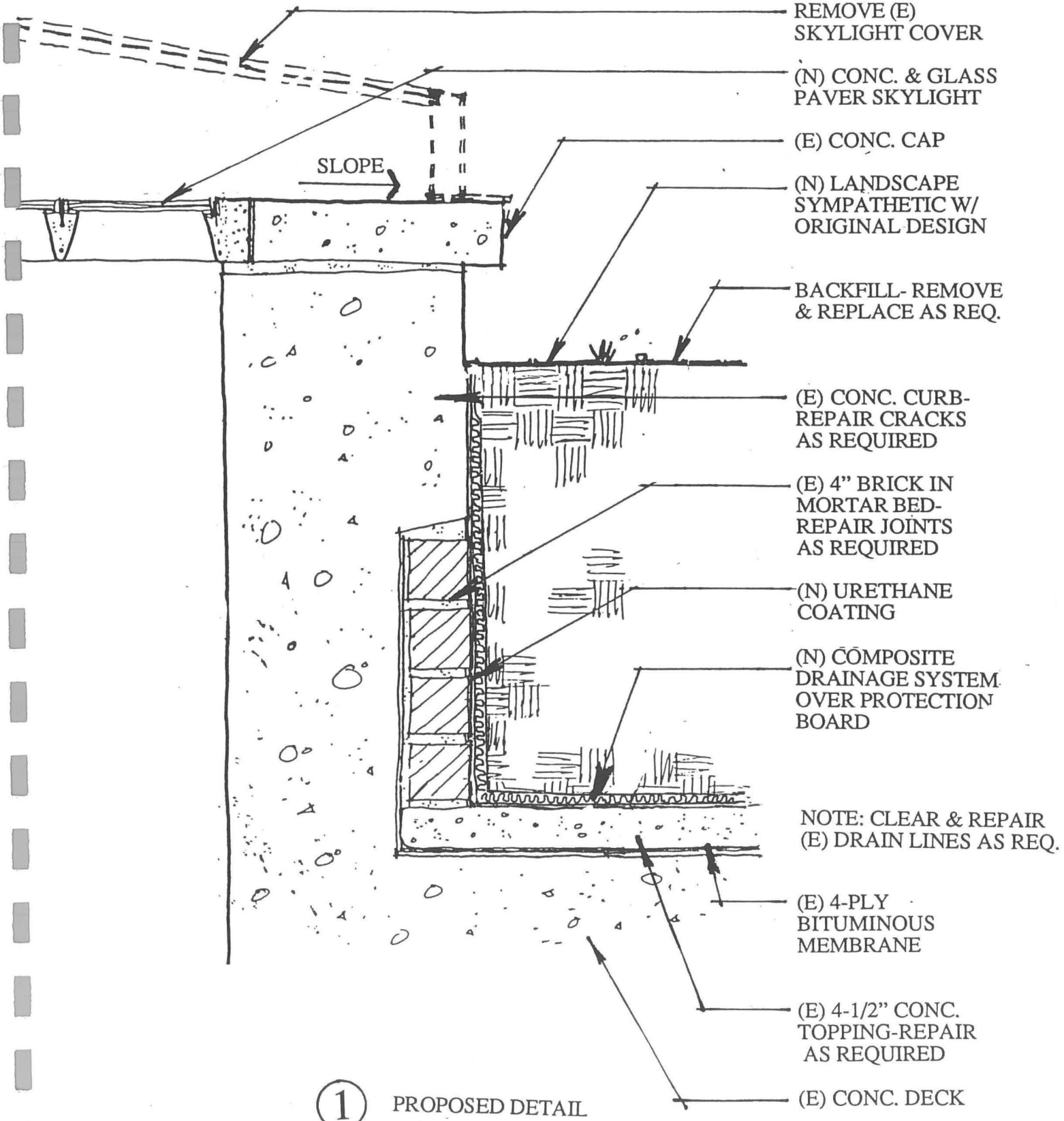
Recommended Option - Conservation

The tiles with a metallic luster glaze should be examined by an objects conservator to determine if the oxidation may be arrested.

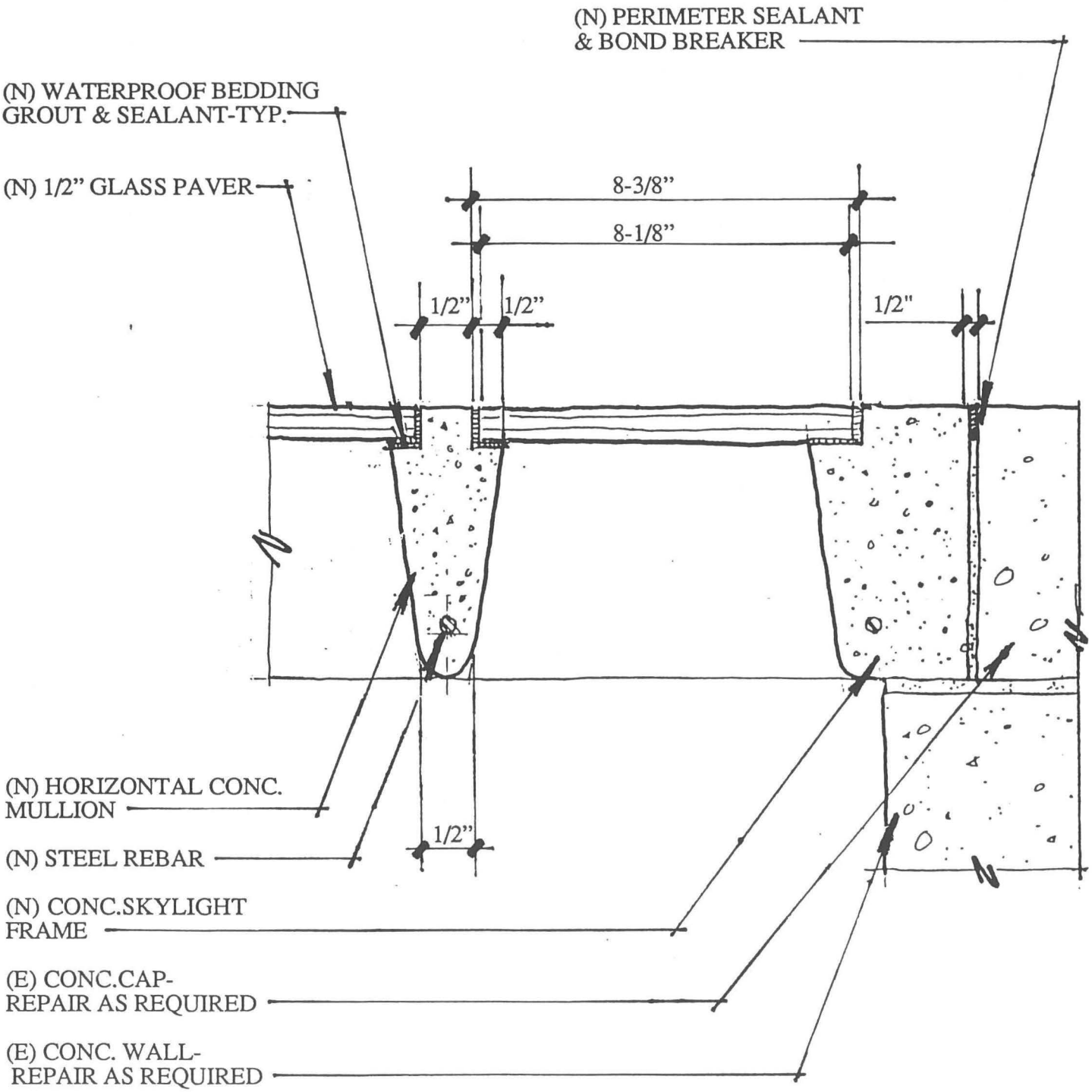
Cost Projection for examination and lab work: $3,000.00

APPENDIX A
SITE PLAN

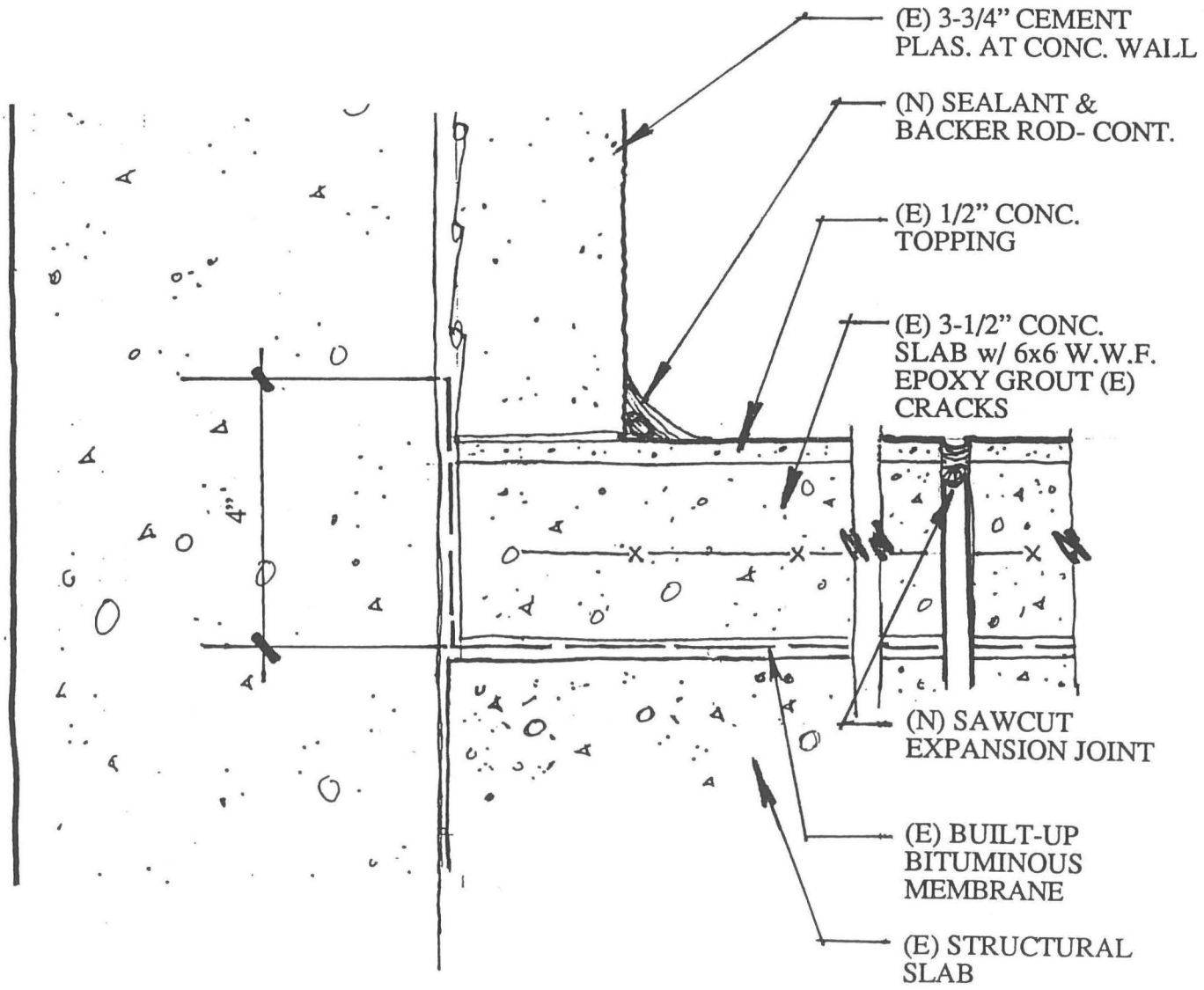
APPENDIX B
PROPOSED TREATMENT DETAILS



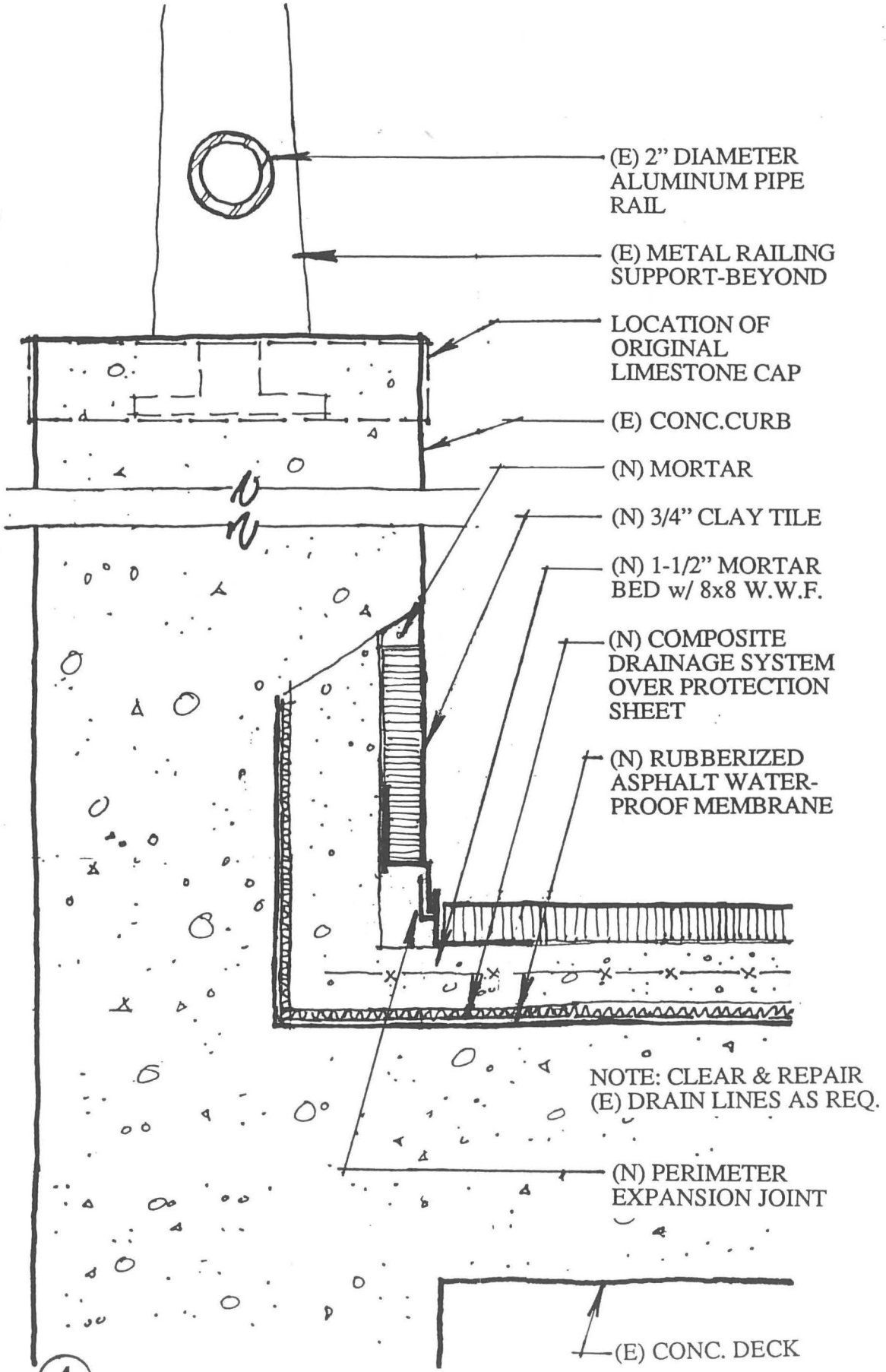
1 PROPOSED DETAIL AT SKYLIGHT



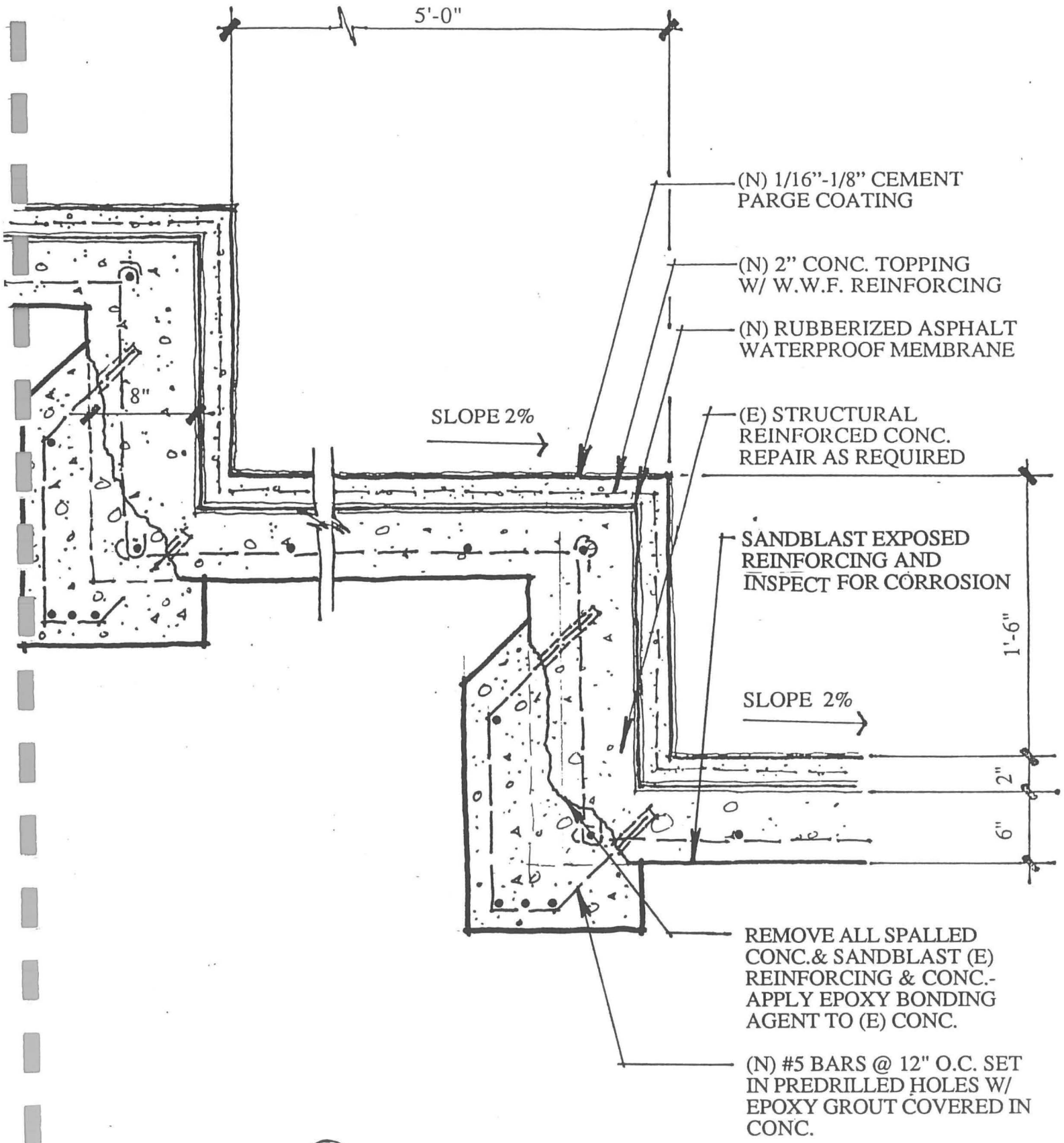
(2) PROPOSED SKYLIGHT DETAIL



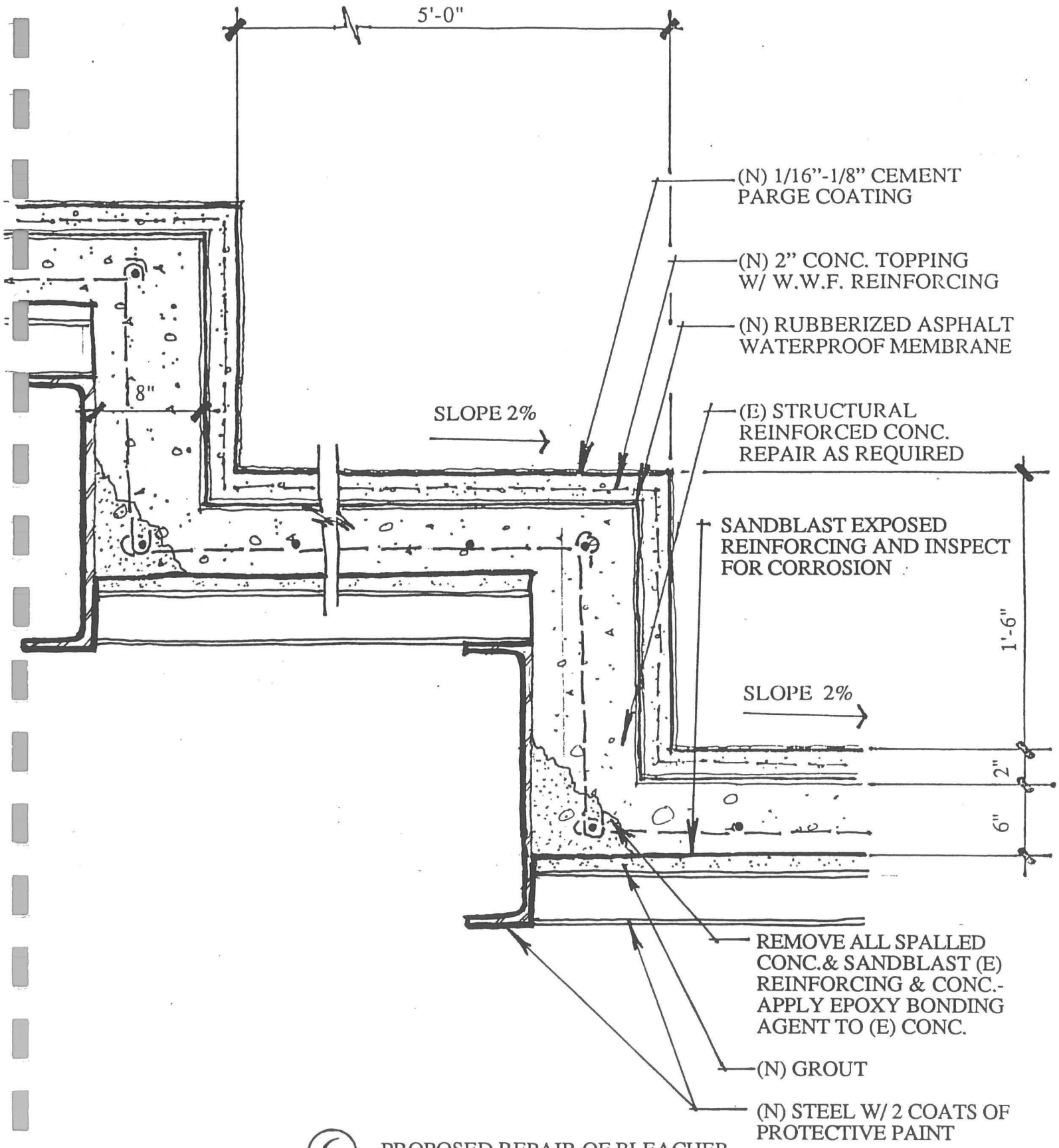
3 PROPOSED RAMP AT BUILDING DETAIL



4 PROPOSED DETAIL @ GUARDRAIL



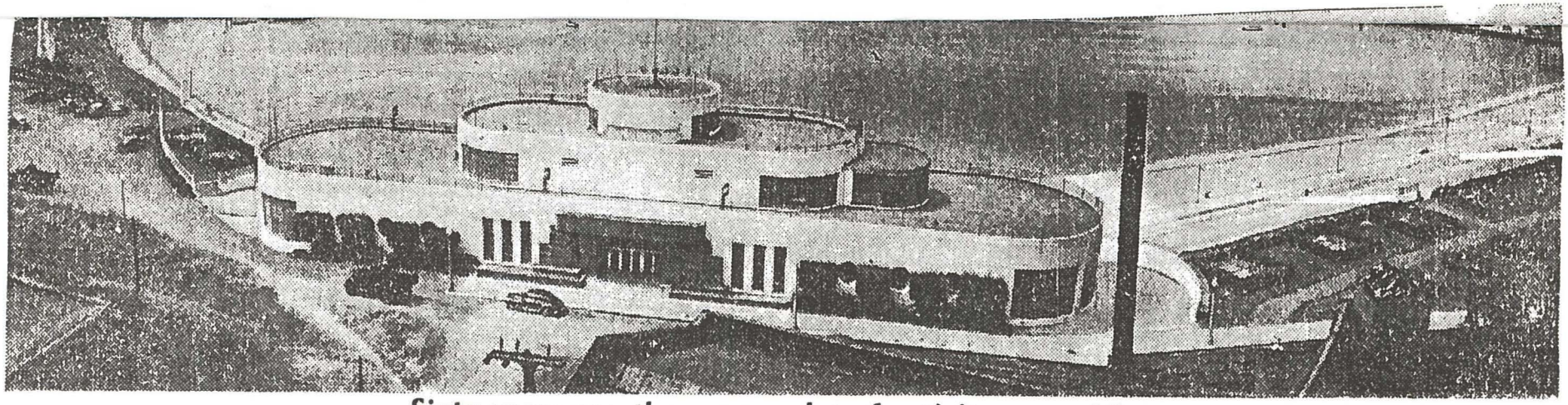
5 PROPOSED REPAIR OF BLEACHER REINFORCED CONCRETE ALTERNATE A



6 PROPOSED REPAIR OF BLEACHER REINFORCED CONCRETE ALTERNATE B

APPENDIX C
CONDITION DRAWINGS

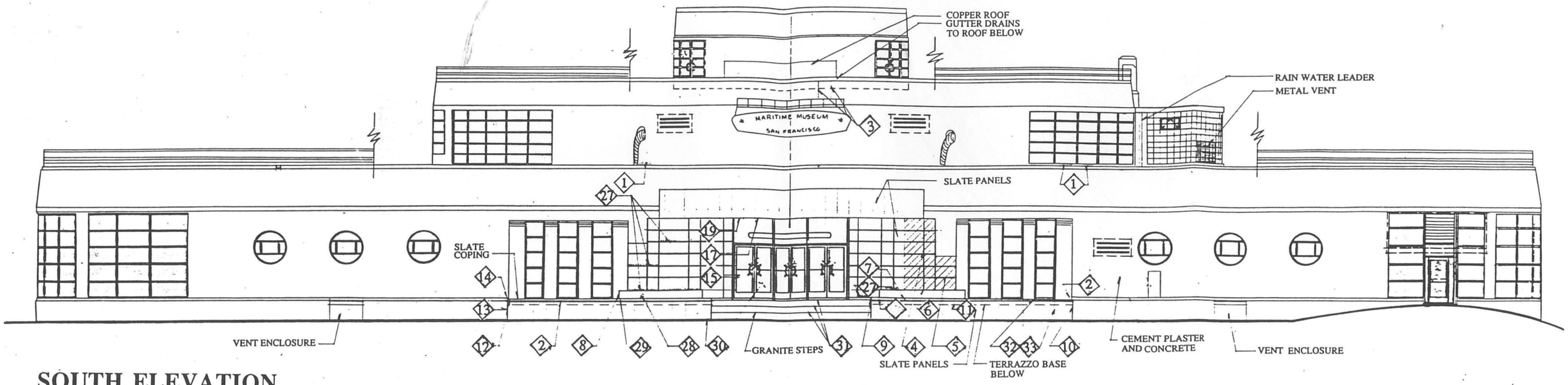
APPENDIX D
HISTORIC PHOTO OF SITE



Sixty years ago there was a lot of activity around here

A FORLORN AND UNUSED LANDMARK

Photo from San Francisco Chroncile, June 28, 1948. J. Porter Shaw Library of the National Maritime Museum.



SOUTH ELEVATION

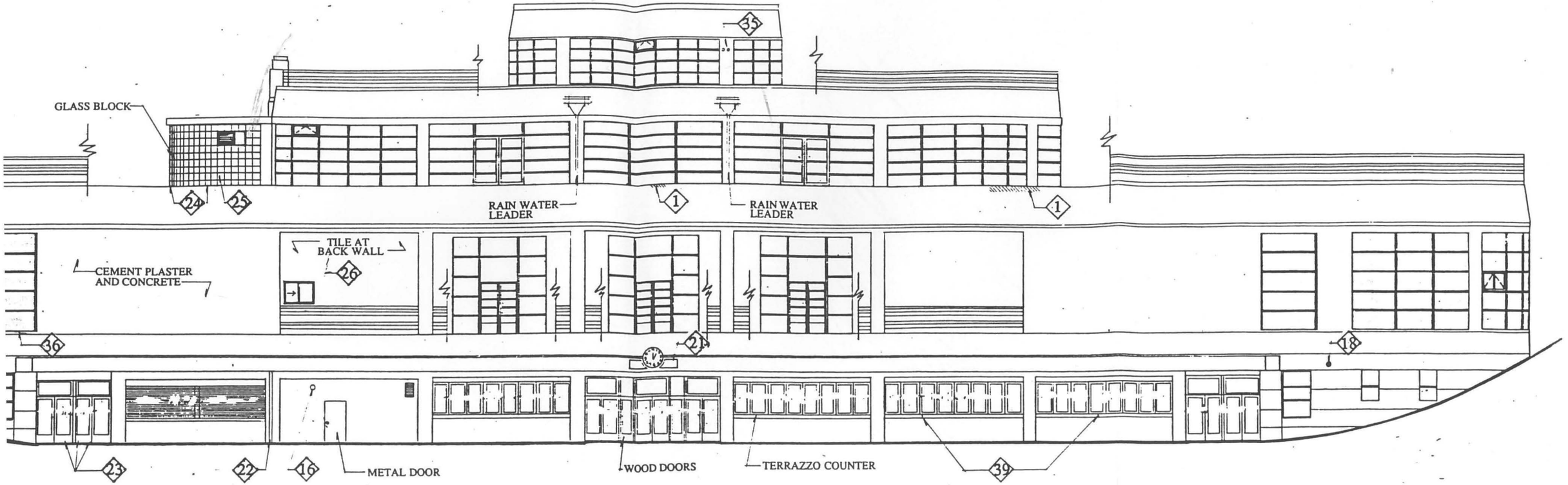
SHEET NOTES

1. Bit patch.
2. Cracked slate coping.
3. Ferrous staining.
11. Crack in terrazzo 15"x3/4"x1'-0"d with ferrous staining.
12. Chipped coping stone.
21. Metal grill appears loose.
22. Undersized or clogged rain water leader.
23. Loss at bottom of wood door.
30. Open joint.
31. Evidence of coating on steps with 50%-60% open joints.

GENERAL NOTES

Heavy build up of coatings causing general horizontal striations.

Windows are surveyed under Architectural Resources Group Maritime Museum Building Window Restoration



ON

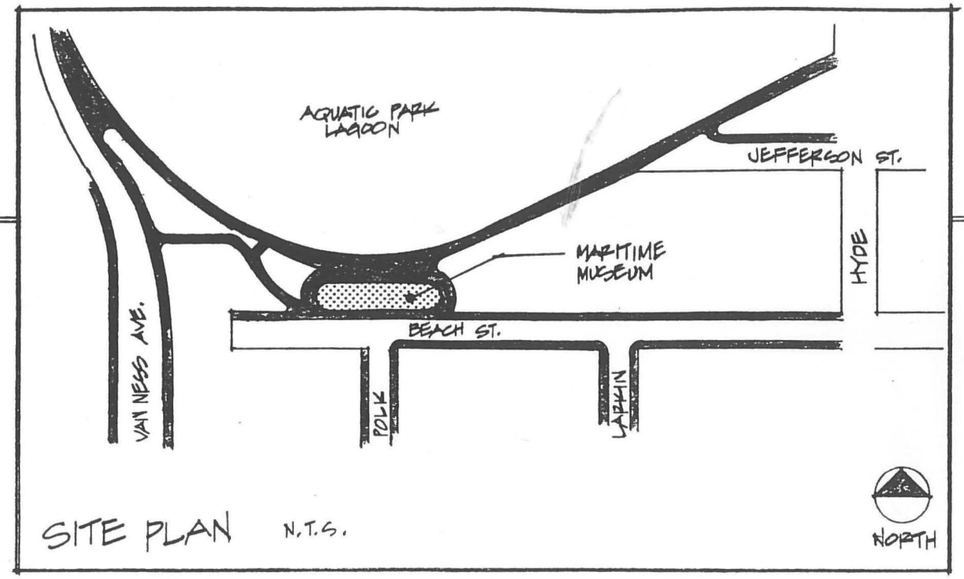
11. Crack in terrazzo 15"x3/4"x1'-0"d with ferrous staining.
12. Chipped coping stone.
13. Displaced base course.
14. Displaced and cracked unit
21. Metal grill appears loose.
22. Undersized or clogged rain water leader.
23. Loss at bottom of wood door.
24. Open and deteriorated joints at glass block.
25. Sixty five damaged glass blocks with water
30. Open joint.
31. Evidence of coating on steps with 50%-60% open joints.
32. Two piece surface spall 6"x10"x1/4"d.
33. Surface spall 4"x8"x1/4"d.

GENERAL NOTES

Heavy build up of coatings causing general horizontal striations.

Windows are surveyed under Architectural Resources Group Maritime Museum Building Window Restoration report

General discoloration and delamination of slate at unit



AQUATIC PARK LAGOON

BEACH STREET